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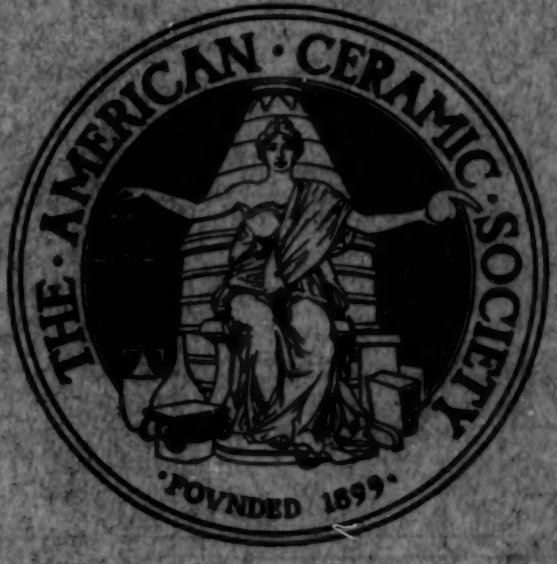

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ABSTRACTS
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NOTES ON THE COLORATION OF GLAZES BY LIGHT*

By C. W. Parmelee and A. E. Badger

ABSTRACT

The actinic darkening of the colors of certain glazes and bodies is described.

I. Introduction

The action of various radiations, solar, radium, and X-ray, on certain glasses is well known, but suggested explanations of the visible changes which take place remain unproved in most cases.

One of the earliest publications dealing with the effect of solar radiation on glass is that of Crookes[1] who noted the development of a violet tint in an originally colorless table glass. Many similar observations have been made, such as that of Gortner,[2] who showed that the intensity of the coloration which was produced in his glass by exposure to sunlight depended on the glass composition and especially on the percentage of manganese present. Glasses which contain selenium or iron are particularly subject to solarization. Zschimmer[3] observed that a selenium glass discolored under an electric light and strips of plate glass changed from a greenish hue to a yellow tint after exposure to daylight. These visible changes must be caused by an alteration in the condition of the glass. Since the elements which impart color to glass are present usually in minute amounts (1 part in 400,000 for some selenium glasses[4]), the chemical nature of the alteration which is produced by light is often beyond the limit of precision of analysis.

Jackson[5] noted that the coloration produced by sunlight disappeared on heating the glass to 500°C. More recently it has been shown[6] that the ultra-violet transmission of glass which has been impaired by solarization can be partly restored by heating the glass to only 200 to 300°C.

The alteration which took place in a manganese glass was investigated by Cross[7] who found that the tinting was confined to a surface zone. After the discovery of radium and of X-rays the effects of their radiations on glass[8] and minerals[9] were soon noted.

II. Effect of Light on Glazes

Similar phenomena may be expected in glazes. Attention was called to a commercial glaze used for wall tile, which changed from an original cream-yellow color to a tan shade after comparatively short exposure to light. The glaze was made from a mixture of flint, whiting, barium carbonate, manganese carbonate, feldspar, zinc oxide, sodium uranate, and Opax, and was fired to cone 9.

Exposure for two months of part of the glazed tile to sunlight coming through a window was sufficient to produce a distinct line of demarcation between the exposed and the protected portions of the glaze. The original color could be restored by refiring the glazed specimen; thereafter the solarizing effect could be repeated. The darkening could be duplicated in a few hours by exposing the glazed piece to the light of a quartz-mercury arc or to that of a carbon arc in air, these sources being rich in ultra-violet radiation. The use of X-radiation from a Coolidge X-ray tube (molybdenum target) caused a similar effect.

The darkening of the above glaze may have been due to the presence of manganese. It might also be a photochemical effect on the zinc compounds[10] in the glaze, the reaction being accelerated by the presence of uranium. This supposition was abandoned when it was found that a similar uranium glaze containing no zinc darkened also after exposure to light. Uranium

* Presented at the Annual Meeting, American Ceramic Society, Pittsburgh, Pa., February, 1933 (White Wares Division). Received October 21, 1933.

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[1] W. Crookes, *Proc. Roy. Soc.* [London], **74**, 524 (1905).

[2] R. A. Gortner, *Jour. Amer. Chem. Soc.*, **39**, 157 (1908).

[3] E. Zschimmer, *Sprechsaal*, **59**, 93 (1926).

[4] A. Cousen and W. E. S. Turner, *Jour. Soc. Glass Tech.* (*Trans.*) **9**, 119 (1924).

[5] H. Jackson, *Nature*, **120**, 264 (1927).

[6] A. Q. Tool and R. Stair, Bur. Stand., *Jour. Research*, **7**, 357 (1931).

[7] C. L. Cross, *Phys. Rev.*, **27**, 108 (1926).

[8] (*a*) P. Gilard and A. Lecrenier, *Chimie & industrie*, **24**, 1035 (1930); (*b*) J. Hoffmann, *Sitzber. Akad. Wiss. Wien Abt. IIa*, **139**, 203 (1930), and **140**, 11 (1931); (*c*) R. Schmidt, *Glastech. Ber.*, **10**, 150 (1932).

[9] J. Hoffmann, *Glastech. Ber.*, **8**, 482 (1930).

[10] For example, calcined ZnS decomposes to form Zn + ZnS_2 under the influence of light and this change is accelerated by the presence of heavy metals. (See C. Ellis and A. A. Wells, The Chemical Action of Ultra-violet Rays, p. 139 (Chemical Catalog Company, 1925).)

glazes possess strong fluorescence,[11] which may have a more pronounced effect in producing discoloration than that which is possessed by the incident light.

In one of the authors' experiments the uranium glaze sample was fired *in vacuo* in order that no dissolved oxygen[12] remain in the glaze to promote a change in the state of oxidation. However, exposure to ultra-violet light caused the usual discoloration. A glaze containing only flint, feldspar, and whiting, as well as a number of commercial glazes of different types, was darkened by exposure to ultra-violet light. Even the body of an unglazed tile was affected by this treatment. The darkening action seems to be a quite general phenomenon.

Since traces of ferrous and ferric iron are present universally in ceramic materials, the conversion of FeO to Fe_2O_3, which reaction is known to take place in glasses[13] exposed to light, may account for the slight darkening of those glazes and bodies which do not contain other light-sensitive components.

Certain glazes are remarkably susceptible to the action of light. One containing flint, feldspar, whiting, boric acid, clay, lead, zinc, tin, and rutile was found to darken after exposure to daylight for less than a minute, the original shade being quickly regained when the glaze was protected. In this instance the sensitivity was ascribed[14] to the presence of titanium in the glaze.

Acknowledgment Appreciation is expressed to R. H. Louden for calling attention to the problem and for coöperation during the course of the experiments. The authors are indebted also to C. H. Zwermann, Jr., for samples of light-sensitive glazes.

[11] O. Krause, *Keramos*, **9**, 791 (1930).
[12] See footnote 3.
[13] D. Starkie and W. E. S. Turner, *Jour. Soc. Glass Tech. (Trans.)* **12**, 306 (1928).
[14] By C. H. Zwermann, Jr.

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NOTES ON CONE 10 SAGGER BODIES WITH TALC AS A COMPONENT*

BY H. THIEMECKE

ABSTRACT

The effect of introducing talc in amounts not exceeding 25% on some of the properties of a sagger body was investigated. The results obtained show improved working properties of the body in the plastic state, increased dry and fired mechanical strength, decreased absorption, lower thermal expansion, increased heat-shock resistance, decreased total shrinkage, decreased sag tendency, smoother fired surface, and darkening of fired color. Talc in amounts greater than 15% shows no appreciable increased benefits, indicating this content to be the practical limit for a commercial cone 10 sagger composition.

I. Experimental

A series of bodies was made with a standard commercial sagger composition as a starting basis, introducing talc in increments at the expense of the plastic and nonplastic components in the proportions in which they occur in the standard body. The exceptions were bodies 2 and 3, compositions indicated later, in which the talc replaced only part of the grog, to simplify calculations and proportioning of materials.

(1) Raw Materials The plastic component, consisting of four domestic clays, ground to pass 20-mesh and blended dry into a "sagger mix," was proportioned with the grog and talc, the whole mixed dry, and then tempered. Scrap saggers of the standard body composition were used for making the grog. The talc was a very pure variety, containing no lime and closely approaching the theoretical composition of silica 63.5%, magnesia 31.7%, and water 4.8%. A residue of 0.6% on a U.S. standard 325-mesh screen was shown.

The sagger mix clay composition, chemical analyses of the four clays and the talc, and the physical properties of the clays and the resulting sagger mix clay are given in Table I.

* Presented at the Annual Meeting, American Ceramic Society, Pittsburgh, Pa., February, 1933 (White Wares Division). Received July 27, 1933.

(2) Body Compositions Eight compositions were investigated, the talc content ranging from 1 to 25%. The compositions by weight were as follows.

Composition	1	2	3	4	5	6	7	8
Sagger mix (%)	60	60	60	57	54	51	48	45
Grog, 6–16 mesh (%)	40	39	37	38	36	34	32	30
Talc (%)	0	1	3	5	10	15	20	25

(3) Test Specimens Transverse-test pieces, 1 by 1 by 7 inches, impact-test pieces, 1/2 by 1/2 by 7 inches, sag-test pieces, 3/8 by 1 by 7 inches, compression- and rattler-test pieces, 1 by 1 by 1 inch, and thermal-expansion test pieces, 1/4 by 1/4 by 3 inches, were in general formed and dried as outlined by the American Ceramic Society Standards.[1] All firing was done in a tunnel kiln to cone 10 touch.

TABLE I

	Clay A	Clay B	Clay C	Clay D	Sagger mix clay
Proportion by weight (%)	40	24	20	16	100
Water of plasticity (%)	23	26	25	20	25
Dry shrinkage (%)	6	6	6	6	6
Dry modulus 1 in. sq. bars, 2 in. span (lb./sq. in.)	86	153	342	184	225
Total shrinkage, cone 10 touch (%)	12.0	19.0	14.0	11.0	14.0
Fired modulus, 5 in. span (lb./sq. in.)	2280	737	4507	3683	2945
Absorption, cone 10 touch (%)	7.7	1.2	1.5	9.7	7.0

	Clay A	Clay B	Clay C	Clay D	Talc
SiO_2	52.59	49.41	61.91	64.90	63.5
Al_2O_3	29.40	33.33	22.97	21.70	0.21
Fe_2O_3	0.63	0.70	1.09	1.00	0.49
TiO_2	3.12	1.34	1.36	1.32	None
CaO	0.44	0.38	0.49	0.36	None
MgO	0.71	0.35	0.72	0.56	31.12
K_2O	1.74	1.75	1.85	1.75	None
Na_2O	0.18	0.38	0.35	0.24	None
Moisture	0.56	0.58	1.06	0.60	
Ignition loss	10.84	11.85	8.37	7.72	5.11

NOTE: Clays A, B, C, and D are Kentucky-Tennessee sagger clays. A, white and gray; B, dark gray; C, gray; and D, light tan.

II. Testing

In general, the methods, apparatus, and calculations given by the American Ceramic Society,[2] were used in determining modulus of rupture, impact, compression, water of plasticity, shrinkage, and absorption values.

[1] *Jour. Amer. Ceram. Soc.*, **11** [6], 459–60 (1928), Sections 61C2 and 62B4.

[2] *Ibid.*, pp. 448–57, 508–28 (1928).

Sag tests were made by firing horizontally the 3/8- by 1- by 7-inch specimens on two knife-edge supports five inches apart. No load was placed at the center of the test pieces. The sagging tendency or sag index of the body under fire is represented by the ratio of the deflection to the span (5 inches) multiplied by 100.

To determine the resistance of the bodies to a combination of abrasion and impact, as prevails in a rattler test, the one-inch cube test specimens

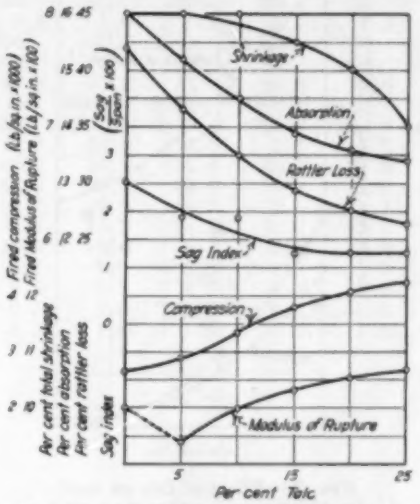

FIG. 1.—Effect of talc on total shrinkage, absorption, rattler loss, compression, sag tendency, and modulus of rupture.

were weighed, rotated with a charge of 25 pebbles of approximately one-inch diameter weighing 640 grams, in a 7- by 8-inch porcelain jar mill for 45 minutes at 75 revolutions per minute and again weighed. The rattler loss is represented by the percentage reduction in weight of the test pieces.

Thermal linear dilatation was carried out on specimens cut to proper length after firing, using a Chevenard industrial thermal analyzer.[3]

In principle, the apparatus, by means of a fused silica rod and a series of levers, records the total linear expansion of the test piece under heat of an electric furnace *vs.* the temperature determined similarly on a standard Pyros rod of 55-millimeter length. A scale is provided with the instrument for reading off the coefficient of expansion direct. The accuracy of the apparatus is within the limits of variation possible on duplicate specimens made by the usual laboratory methods.

[3] Supplied by the R. Y. Ferner Company, Washington, D. C.

The effect of heat shock on transverse, impact, and compressive strengths and rattler life was determined by heating the specimens to and holding them at 400°C for 30 minutes, quenching in water at room temperature (25°C), and then testing as outlined for the unquenched specimens. The tendency for failure of the bodies under heat-shock treatment, or heat-shock loss, is represented by the percentage reduction in values of the test pieces with respect to those obtained on unquenched specimens.

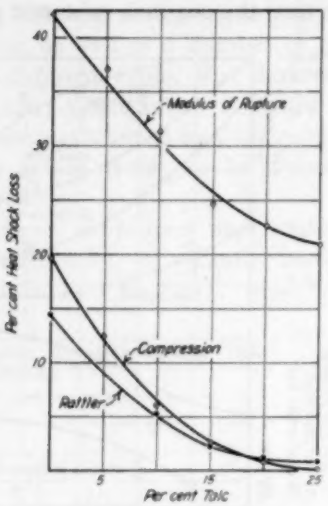

FIG. 2.—Effect of talc on modulus of rupture, compression, and rattler heat-shock loss.

Microscopic examinations of thin sections were also made to determine, if possible, any development of glass or crystal phases.

III. Results

The effects of additions of talc to the standard sagger body composition on the various physical properties are shown in Table II. Values for modulus of rupture, total shrinkage, compression, and impact are an average made on ten test pieces. All other values, excepting those for coefficient of expansion and water of plasticity for which only two determinations were made, are an average obtained on five specimens. Due to the large mass of the hammer of the Charpy impact machine, sufficient sensitivity was not obtained to show slight variations in the impact strength of the bodies.

The mean linear coefficients of expansion of the fired sagger clay mix alone were as follows:

From 25–100°C	12.3×10^{-6}
From 25–200°C	10.1×10^{-6}
From 25–300°C	8.7×10^{-6}
From 25–400°C	7.7×10^{-6}

The effects of talc variations on the more important physical properties are shown graphically in Figs. 1, 2, and 3.

With increasing amounts of talc, the bodies became more plastic and filled out the corners of the steel mold more easily under pressure during the forming of the test pieces.

The color of the fired bodies varied directly with the talc content from a buff for composition No. 1 to a golden brown, similar to ripened wheat, for composition No. 8. In appearance and feel the surface of the bodies also became more smooth with increasing amounts of talc, the clay itself not only being more smooth but the usual small cracks in the clay covering grog particles near the surface being smaller and fewer in number.

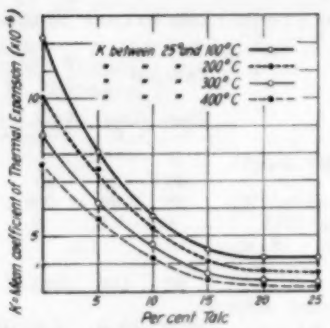

FIG. 3.—Effect of talc on mean coefficient of thermal expansion.

Microscopic study revealed definitely that the talc, under the action of heat, did not attack the inert grog, but affected only the plastic element. This action was evidenced by a sharp outline between the continuous clay phase and the discontinuous grog phase in all of the bodies, the grog particles showing extensive but uniform mullite development throughout their mass from previous repeated firing, with no gradient from edge of particle to center as would be the case had the talc reacted. The effect of the talc on the continuous phase was to produce fine mullite crystallites, much smaller than those in the grog, and in increasing amounts with increased talc content. No appreciable increase of mullite

development or size of crystals was observed with talc contents greater than 15%.

Of particular interest was the greater development of mullite in local areas between grog particles, where the clay seemed to flow under pressure during the forming of the test pieces. In such cases, the mullite crystallites were oriented with their long axes parallel to the lines of clay flow.

No other crystal phases except large particles of free quartz were evident, although from a study of the equilibrium diagram of the system MgO–Al_2O_3–SiO_2 (Fig. 4) which shows the composition of the bodies investigated on the basis of the clay and talc contents alone, it becomes manifest that the formation of other crystal phases is theoretically possible under the degree of firing attained, due to localized concentrations of the components.

Areas of free glass were absent, or if not entirely absent, probably masked by the phenomenon of "white opacity" of the mullite crystallites, analogous to a suspension of fine particles of flint in water, the mullite and glass acting the parts of flint and water, respectively.

TABLE II

Composition	1	2	3	4	5	6	7	8
Talc content (%)	0	1	3	5	10	15	20	25
Water of plasticity (%)	17	18	18	18	19	18	18	18
Dry shrinkage (%)	6	6	6	6	6	6	6	6
Dry modulus, 2-in. span (lb./sq. in.)	88	88	90	95	100	108	113	118
Total shrinkage, cone 10 touch (%)	8.0	8.0	8.5	8.0	8.0	7.75	7.5	7.0
Fired modulus, 5-in. span (lb./sq. in.)	1000	1000	1020	940	1000	1030	1050	1065
Fired modulus after heat shock (lb./sq. in.)	580	590	600	590	687	775	810	840
Modulus of rupture heat-shock loss (%)	42.0	41.0	40.8	37.2	31.3	24.8	22.8	21.0
Fired compression (lb./sq. in.)	2650	2720	2750	2880	3340	3800	4050	4220
Fired compression after heat shock (lb./sq. in.)	2130	2190	2230	2520	3140	3700	4010	4210
Compression heat shock loss (%)	19.6	19.4	18.9	12.5	6.0	2.6	1.0	0.3
Rattler loss (%)	42.0	40.2	38.0	36.6	32.4	29.2	27.6	26.2
Rattler loss after heat shock (%)	48.0	45.9	43.2	39.9	34.1	29.9	27.9	26.4
Rattler heat shock loss (%)	14.3	14.2	13.7	9.0	5.2	2.4	1.1	0.8
Absorption, cone 10 touch (%)	16.0	15.8	15.5	15.2	14.5	13.9	13.6	13.4
Mean coefficient of expansion, 25–100°C ($\times 10^{-6}$)	12.2	12.0	12.0	8.0	5.7	4.5	4.2	4.2
" " " " 25–200°C	10.0	10.0	9.7	7.4	5.3	4.0	3.7	3.6
" " " " 25–300°C	8.7	8.7	7.7	6.2	4.7	3.6	3.4	3.3
" " " " 25–400°C	7.5	7.5	6.7	5.6	4.2	3.4	3.2	3.1
Sag index	2.50	2.50	2.50	1.88	1.88	1.25	1.25	1.25

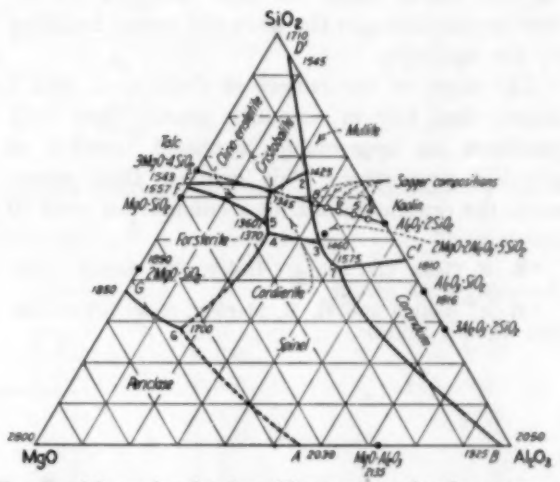

FIG. 4.—Magnesia–alumina–silica system showing sagger compositions on basis of talc and plastic clay contents.

IV. Discussion

From a study of Fig. 1, it is evident that increasing amounts of talc give increased mechanical strength as to cross-bending, compression, abrasion, and impact. This effect may have been brought about by increasing amounts of glass (evidenced by the decreased absorption and the varying degrees of mullite development, since usually it is understood that crystals develop to a large size and in greater amounts when a glass is present into which the crystals can grow), by progressive changes in the nature of the glass itself, by the interlocking network of mullite crystallites, or by a combination of these factors. Sag resistance is doubtless due to the network of mullite crystals developed.

Compounds	MgO	Al_2O_3	SiO_2	Temperature
Periclase	100			2800
Corundum		100		2050
Cristobalite			100	1710
Spinel ($MgO \cdot Al_2O_3$)	28.4	71.6		2135
Forsterite ($2MgO \cdot SiO_2$)	57.1		42.9	1890
Clinoenstatite ($MgO \cdot SiO_2$)	40.0		60.0	1557
Sillimanite ($Al_2O_3 \cdot SiO_2$)		62.8	37.2	1816
Cordierite ($2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$)	13.7	34.9	51.4	
Mullite ($3Al_2O_3 \cdot 2SiO_2$)		71.8	28.2	

The increased resistance of the bodies to mechanical failure under heat shock with increase of talc (Fig. 2) can be explained by the lowered coefficient of expansion, contributed to in part by the mullite. However, since the coefficient of expansion of mullite[4] is given as 5.3×10^{-6}, some other factors must enter to give the lower value of 3.1×10^{-6} obtained on composition No. 8. The presence of a glass of low expansion or some unobserved crystal phase such as cordierite having the low expansion coefficient[5] of 1×10^{-6} may have been influential. The fact that cordierite in one of its forms, ranges from yellow-brown to dark brown and that the bodies become increasingly darker with increments of talc, tends to substantiate such correlation.

Undoubtedly the lowered total shrinkage of the clay with additions of talc tended to reduce the exposure of the preshrunk grog particles near the surface of the test pieces and gave a smoother body. Such increased tightness of saggers would make for less dropping of refractory particles on the ware and easier handling by the workmen.

The slope of the curves in Figs. 1, 2, and 3 shows that talc in amounts greater than 15% produces no appreciable increased benefits in physical properties. This content then represents the practical limit for a commercial cone 10 sagger body approaching the basic composition used throughout this investigation.

[4] R. F. Geller and Herbert Insley, Bur. Stand., *Jour. Research*, **9**, 35 (1932).

[5] G. A. Rankin and H. E. Merwin, *Amer. Jour. Sci.* [4], **45**, 301 (1918).

V. Summary

The introduction of a relatively pure talc in a standard cone 10 sagger composition resulted in (*a*) better working properties in the plastic state, (*b*) increased dry and fired mechanical strengths, hence less loss of saggers in handling, (*c*) smoother fired surfaces, (*d*) darkening of the fired color from a buff to a golden brown, (*e*) decreased total shrinkage, (*f*) decreased absorption with possible better heat conductivity, (*g*) lower coefficient of expansion, giving increased heat-shock resistance, (*h*) decreased sag tendency, and (*i*) increased mullite development. The improvement in physical properties of the fired bodies derived from the talc in amounts greater than 15% was of such a magnitude as not to warrant additions exceeding this limit.

NOTE: Data on a commercial lot of saggers having the same percentage composition as body No. 6, but with the grog ranging from 2- to 16-mesh and the talc component containing 6.5% CaO are not sufficiently complete at this date to afford confirmation of the increased service life which would be expected from the results obtained in this investigation carried on under laboratory conditions.

Acknowledgments The writer wishes to record his indebtedness to H. Wynne of the Research Department, Westinghouse Electric & Manufacturing Company, for determining the chemical compositions of the raw materials used and to Dr. McCaughey, Mineralogy Department, Ohio State University, for his helpful coöperation and advice in the petrographic examinations and interpretations.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
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LATTICE DIMENSIONS OF SOME SOLID SOLUTIONS IN THE SYSTEM $MgO–Al_2O_3$*

By G. L. Clark, E. E. Howe, and A. E. Badger

ABSTRACT

The lattice dimension of magnesia spinel was determined to be $a_0 = 8.064 \pm 0.002$ A.U. The lattice dimension of solid solutions of this spinel with αAl_2O_3 decreases progressively with increase of Al_2O_3.

I. Introduction

The system $MgO–\alpha Al_2O_3$ as determined by Rankin and Merwin[1] is illustrated by Fig. 1, which shows that fusions of MgO and Al_2O_3 form solid solutions of spinel ($MgO \cdot Al_2O_3$) with αAl_2O_3 when the proportion of Al_2O_3 in the melt is greater than 71.6%. The determination of the lattice dimensions of some members of this solid solution series, including the important end-member, magnesia spinel ($MgO \cdot Al_2O_3$), is described in the following account.

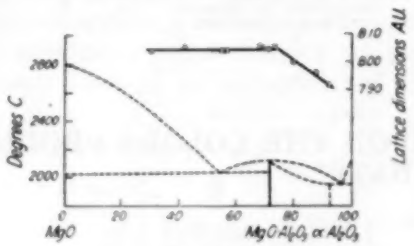

Fig. 1.

II. Experimental Method

Chemically pure powdered MgO and Al_2O_3 in proportions varying from about 32 to 93% Al_2O_3 were ground intimately in an agate mortar. The mixtures of oxides were fused by exposure to the radiation from a carbon arc and the resulting crystalline materials were subjected to X-ray analysis by the Hull powder method using the Kα radiation from a Coolidge-type molybdenum target X-ray tube.

Attempts to make pure $MgAl_2O_4$ by chemical precipitation were not successful. In one experiment 12 grams of $MgCl_2 \cdot 6H_2O$ were dissolved in 340 grams of KOH and 60 cubic centimeters of H_2O by heating to about 200°C in a nickel crucible.[2] The solution of $Mg(OH)_2$ thus formed was added to a concentrated solution of $KAlO_2$ made by dissolving $AlCl_3$ in concentrated KOH solution. The formation of $MgAl_2O_4$, which might be expected on mixing the above solutions did not occur.

III. Results

Lattice dimensions computed from measurements of the X-ray diffraction lines are listed in Table I and are represented graphically in Fig. 1 in order to show their relationship to the system $MgO–Al_2O_3$.

Table I

Lattice Dimensions of Solid Solutions in the System $MgO–Al_2O_3$

Al_2O_3 (%)	Lattice dimension (A.U.)
32.1	8.06
40.7	8.07
54.7	8.05
55.4	8.05
69.8	8.07
71.5	8.06
71.6 ($MgO \cdot Al_2O_3$)	8.06
73.6	8.06
80.8	8.00
85.8	7.97
92.9	7.93

Table II

Lattice Dimension of $MgAl_2O_4$ Synthesized by Fusion of Oxides

Measurements of X-Ray Diffraction Lines Obtained by the Hull Powder Method

Indices of crystal plane	d/n	Relative intensity	a_0 in A.U.
100(4)	2.015	5	8.06
112(2)	1.649	2	8.07
111(3), 115(1)	1.552	7	8.06
110(4)	1.429	10	8.08
135(1)	1.360	1	8.05
130(2)	1.273	1	8.05
335(1)	1.230	3	8.07
111(4)	1.162	2	8.05
155(1), 117(1)	1.130	1	8.07
123(2)	1.078	1	8.07
355(1), 137(1)	1.049	3	8.06
100(8)	1.009	1	8.07
110(6), 114(2)	0.951	1	8.07
111(5), 157(1)	0.931	2	8.06
120(4)	0.902	1	8.07
139(1)	0.846	1	8.07
112(4)	0.822	1	8.05
134(2)			
150(2)			
159(1), 377(1)	0.780	1	8.07

Mean $a_0 = 8.064 \pm 0.002$

* This paper will be presented at the Annual Meeting, American Ceramic Society, Cincinnati, Ohio, February, 1934 (White Wares Division). Received October 27, 1933.

[1] G. A. Rankin and H. E. Merwin, *Jour. Amer. Chem. Soc.*, **38**, 571 (1916).

[2] See J. W. Mellor, A Comprehensive Treatise on Inorganic and Theoretical Chemistry, Vol. IV, p. 290 (Longmans, Green & Co., London, 1923).

Reference to Fig. 1 shows that a fusion of MgO and Al_2O_3 in equimolecular proportions resulted in the formation of common magnesia spinel which has a lattice dimension of about 8.06 A.U. If an excess of Al_2O_3 was present, the solid solution of this oxide in spinel caused a progressive decrease in the lattice dimension. Excess MgO did not distort the spinel lattice since a solid solution was not formed.

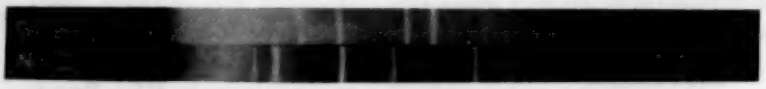

FIG. 2.—X-ray diffraction pattern (reduced size) of magnesia spinel compared with that of NaCl as obtained by the Hull powder method.

Special care was taken in the synthesis and X-ray analysis of the compound $MgO \cdot Al_2O_3$. The X-ray diffraction pattern (reduced size) of this spinel with reference lines of NaCl is shown in Fig. 2. Measurements of the diffraction lines given in Table II show that the lattice dimension[3] of pure $MgAl_2O_4$ is $a_0 = 8.064 \pm 0.002$ A.U. This value is a downward revision of the value, $a_0 = 8.086 \pm 0.003$ A.U., which was obtained previously[4] on magnesia spinel synthesized at lower temperatures with the aid of a boric acid flux. The new value agrees well with Hauptmann and Novak's[5] recent determination of $a_0 = 8.059 \pm 0.004$ A.U.

[3] The probable error of the mean value was obtained by means of Student's factors, *Biometrika*, **6**, 1 (1908), **71**, 416 (1917); *Metron.*, **5**, 18 (1925).

[4] G. L. Clark, Abde Ally, and A. E. Badger, *Amer. Jour. Sci.* [5], **22**, 544 (1931).

[5] H. Hauptmann and J. Novak, *Z. physik. Chem.*, **B15**, 371 (1932).

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THE EFFECT OF GLAZE COMPOSITION UPON THE COLORS PRODUCED BY SODIUM URANATE*

BY KARL KAUTZ

ABSTRACT

A study was made of the effect of glaze composition upon the colors produced by sodium uranate at cones 6 to 7 in which hundreds of trials were made. Typical compositions of glazes are given which react with sodium uranate to produce green, yellow, ivory, orange, and red colors. Notes on the effect the different glaze constituents have upon the color are also given.

I. Introduction

The purpose of this investigation was to develop at cones 6 to 7, the best yellow color possible under the conditions at hand, using sodium uranate ($Na_2O \cdot 2UO_3 \cdot 6H_2O$) as colorant. In the course of the investigation a great variety of colors other than yellow were produced. Many of these were used commercially.

II. Experimental Methods

Raw glazes were used in most of the compositions. Where raw glazes were not practical, partially fritted glazes were made by incorporating a general type of frit, such as $Na_2O \cdot CaO \cdot \frac{1}{2}Al_2O_3 \cdot 2B_2O_3 \cdot 5SiO_2$, in the glaze batch.

Variations in the glaze composition, in the amount of opacifier, and in the amount of sodium uranate were made by wet blending two end members into a five- or six-member series.

The glazes were applied by spraying at a specific gravity of 1.80 to bisque vitreous china samples, $\frac{1}{2}$ by 3 by 6 inches. The trials were fired in closed saggers in a 375-foot Harrop car tunnel kiln to cones 6 to 7 with a firing schedule of 108 hours through the kiln.

III. Results

A complete account of the many trials made and the results obtained can not be listed here. Dependent upon the composition of the glaze, sodium uranate may be used at cones 6 to 7 to produce green, yellow, ivory, orange, or red colors. Following are given some of the typical glaze compositions which produced the best colors.

(1) Green Glaze The composition of the best green glaze is as follows:

* Received May 20, 1932.

$$\left.\begin{matrix}0.30\ K_2O\\0.50\ CaO\\0.15\ ZnO\\0.05\ Na_2O\end{matrix}\right\}0.30\ Al_2O_3\left\{\begin{matrix}2.40\ SiO_2\\0.10\ UO_3\end{matrix}\right.$$

This composition produced a dark olive green glaze of unpleasing appearance and with a mat texture. No attempts were made to use this color commercially as better green colors can be made by other means.

(2) Yellow Glaze The best yellow color is produced with a glaze of the following composition:

$$\left.\begin{matrix}0.35\ Na_2O\\0.25\ CaO\\0.15\ BaO\\0.25\ ZnO\end{matrix}\right\}0.35\ Al_2O_3\left\{\begin{matrix}2.80\ SiO_2\\0.12\ ZrO_2\end{matrix}\right.$$

Three to four per cent of sodium uranate is added to this glaze in terms of the batch weight. The composition produces a very bright yellow glaze of excellent color but difficult to control. By the addition of PbO and B_2O_3 to the glaze the pure yellow color is sacrificed somewhat but a good commercial color is obtained. A glaze of this type is produced by the addition of 7% zirconium oxide and 3% sodium uranate to the following composition:

$$\left.\begin{matrix}0.30\ Na_2O\\0.30\ CaO\\0.20\ ZnO\\0.10\ PbO\\0.10\ BaO\end{matrix}\right\}0.35\ Al_2O_3\left\{\begin{matrix}2.80\ SiO_2\\0.20\ B_2O_3\end{matrix}\right.$$

This glaze was used quite extensively for the production of colored ware.

(3) Ivory Glaze Ivory colored glazes of different shades are produced by the addition of 6% tin oxide and from 1 to 2% sodium uranate to the following composition:

$$\left.\begin{matrix}0.20\ K_2O\\0.20\ CaO\\0.40\ PbO\\0.20\ ZnO\end{matrix}\right\}0.30\ Al_2O_3\ \{\ 3.00\ SiO_2$$

This glaze was used commercially quite successfully.

(4) Orange Glaze A brownish orange glaze is produced by the addition of 5% tin oxide and 6 to 8% sodium uranate to the following glaze:

$$\left.\begin{matrix}0.14\ K_2O\\0.11\ CaO\\0.41\ PbO\\0.34\ ZnO\end{matrix}\right\}0.20\ Al_2O_3\left\{\begin{matrix}2.00\ SiO_2\\0.20\ B_2O_3\end{matrix}\right.$$

This glaze was used commercially.

(5) Red Glaze A vermillion red color may be produced with high lead glazes free from Al_2O_3. A pleasing red glaze of this type with a crystalline texture is obtained with the following composition:

$$\left.\begin{matrix}0.90\ PbO\\0.10\ Na_2O\end{matrix}\right\}0.20\ UO_3\ \left\{2.00\ SiO_2\right.$$

This glaze was used only for the production of a few small pieces of art ware.

IV. The Effect of Glaze Composition on Color

The different chemical compounds used in compounding glazes have a decided effect upon the color produced by sodium uranate. The conclusions given below are based upon the results of a large number of trials with cones 6 to 7 glazes in which the oxide listed is part of a well-balanced glaze.

Chemical oxide	Color produced	Maximum amount used
K_2O	Greenish yellow	0.40
Na_2O	Strong pure yellow	0.40
CaO	Yellowish green	0.60
BaO	Strong pure yellow	0.20
MgO	Weak pale yellow	0.10
ZnO	Brownish yellow	0.40
PbO	Orange-brown	0.60
B_2O_3	Weak pale yellow	0.40
SnO_2	Brownish yellow	0.20
ZrO_2	No effect	0.30
SiO_2	" "	3.00
Al_2O_3	" "	0.40

Alumina has no effect when introduced in the form of a vitreous frit or feldspar, but when added as clay in amounts greater than 0.10 equivalent, it produces black specks in the glaze.

Fluorine, introduced either as fluorspar, CaF_2, or cryolite, $3NaF{\cdot}AlF_3$, into the mill batch, has an injurious effect upon both the glaze and color at cones 6 to 7. This is contrary to Hegemann in his book, Des Porzellans, who claimed that fluorspar gave improved brilliancy of the yellow color.

V. Summary

(1) Green sodium uranate glazes should contain a high content of K_2O and CaO, a low content of other fluxes and clay, and should not contain PbO and B_2O_3.

(2) Yellow sodium uranate glazes should contain a high content of Na_2O and BaO, a medium amount of CaO and ZnO, and a low clay content. They may contain a small amount of

PbO and B_2O_3. For enamels, ZrO_2 produces clearer yellow colors than SnO_2.

(3) Ivory sodium uranate glazes or enamels should contain medium amounts of PbO and ZnO. They may contain medium amounts of K_2O, Na_2O, CaO, or B_2O_3 and the clay content should not exceed 0.10 equivalent. SnO_2 should be used as an opacifier.

(4) Orange sodium uranate glazes or enamels should contain a high content of metallic fluxes such as PbO and ZnO, and a low content of alkali and alkaline earth fluxes such as K_2O, Na_2O, CaO, BaO, and MgO. B_2O_3 may be used to advantage and the clay content should not exceed 0.10 equivalent.

(5) Red sodium uranate glazes of deepest color are produced with simple lead silicate glazes.

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FACTORS INVOLVED IN THE PRODUCTION OF GLAZED BRICK BY THE DRY-PRESS PROCESS*

By W. C. Rueckel

ABSTRACT

Brick were made by the dry-press process from two fire clays with varying grain size, moisture content, and forming pressure. The effect of de-airing the mold box prior to compression was also studied. Glazed brick made in this investigation were compared with stiff-mud glazed brick and the properties of the former were found to equal those of the stiff-mud glazed brick when the forming variables were closely controlled.

I. Introduction

(1) Dry-Press *vs.* Stiff-Mud Process

Dry pressing has the advantages over the stiff-mud process of (1) greater uniformity in size of ware, (2) straight and sharp edges, (3) elimination of defects due to cutter wires, (4) elimination of cupped brick, (5) elimination of many common drier defects, and (6) ease with which the dry press and tunnel kiln can be adapted to a straight-line method of production.

Unfired brick with defective edges produce crawling and delayed crazing as well as a poor glaze surface. This has made it necessary for some producers of stiff-mud glazed brick to grind the clay to an excessive fineness. In one case 85% passes a 200-mesh screen.

The major object of this investigation was to determine whether brick made by the dry-press process are equal or superior to those made by the stiff-mud process in regard to appearance and ability of the ware to withstand crazing.

* Presented at the Annual Meeting, American Ceramic Society, Pittsburgh, Pa., February, 1933 (Structural Clay Products Division). Received August 5, 1933.

II. Preparing the Samples

The two clays used in the investigation are used to produce exceptionally good one-fire glazed ware by the stiff-mud process. These clays are of two very different types. The one is a sandy fire clay, designated as *S*. The other is a plastic fire clay, designated as *P*. Both clays were secured from the mine in lump form. Half of each type of clay was ground to pass a 14-mesh sieve, while the remainder was ground to pass a 20-mesh sieve. The 14-mesh clay is designated as coarse, *C*, and the 20-mesh as fine. *F*

Table I

Sieve Analysis of the Ground Clays

		SC	*SF*	*PC*	*PF*
Retained on	14-mesh (%)	4.54		0.85	
" "	20- " "	31.10	1.20	24.32	0.22
" "	28- " "	21.14	14.23	7.33	14.36
" "	35- " "	9.67	14.33	8.12	15.56
" "	48- " "	5.45	9.88	6.38	11.56
" "	65- " "	2.43	6.80	8.50	10.94
" "	100- " "	7.12	12.19	9.43	10.18
" "	150- " "	2.90	7.49	5.07	8.38
" "	200- " "	3.09	8.18	6.34	5.42
Through	200- " "	11.33	24.80	22.30	20.44
Total (%)		98.75	99.20	98.54	97.06

The four variations of clay and grind were split into equal batches and one-half of each batch was tempered with water to a total water content of 4%, while the other half was tempered to a total water content of 7%. After the tempered clay had aged for 24 hours it was formed into brick at pressures of 500, 1500, and 3500

pounds per square inch. Since pressure cracks developed at certain pressures with certain variations in clay, grind, and moisture the entire test was duplicated using an evacuated mold. Five brick were made of each batch, varying in grind, moisture, pressure, and vacuum. The pressure was applied at a 20-second cycle.

The green brick were air dried and returned to the plants from which the clay had been obtained for glazing and firing. The dried brick made from the plastic fire clay were sprayed with a mat glaze, while the brick made from the sandy fire clay were sprayed with a clear bright glaze.

TABLE II

BODY *P*—PLASTIC FIRE CLAY

	Unevacuated			Evacuated		
Serial No.	Fired bulk density (lb./cu. in.)	Total shrinkage (%)	Absorption (%)	Fired bulk density (lb./cu. in.)	Total shrinkage (%)	Absorption (%)
4*C* 500	*	*	*	0.0669	2.02	13.07
4*C* 1500	0.0759	1.80	8.74	0.0762	1.87	8.51
4*C* 3500	0.0809	2.16	5.97	0.0799	1.99	6.07
4*F* 500	0.0702	2.16	12.49	0.0713	2.20	11.18
4*F* 1500	0.0760	2.28	8.28	0.0772	2.20	7.33
4*F* 3500	0.0798	2.41	6.27	0.0799	2.41	5.94
7*C* 500	0.0736	2.12	9.87	0.0724	2.28	10.55
7*C* 1500	0.0791	2.45	6.73	0.0787	2.47	6.53
7*C* 3500	0.0803	1.91	5.89	0.0809	2.53	5.13
7*F* 500	0.0723	2.58	11.30	0.0736	2.71	10.11
7*F* 1500	0.0787	2.77	7.19	0.0786	2.96	7.03
7*F* 3500	0.0807	2.92	6.17	0.0799	3.12	6.01

* Brick so soft they were broken in handling.
Av. fired bulk density of stiff-mud brick: 0.0788 lb./cu. in.
Av. fired absorption of stiff-mud brick: 5.14%.
Av. total shrinkage of stiff-mud brick: 9.09%.
N.B. In the above and following tables, under serial designation, the first numeral indicates the water content as either 4 or 7%, the letter *C* or *F*, 14- or 20-mesh material, respectively, and the last numeral indicates the forming pressure in pounds per square inch.

TABLE III

BODY *S*—SANDY FIRE CLAY

	Unevacuated			Evacuated		
Serial No.	Fired bulk density (lb./cu. in.)	Total shrinkage (%)	Absorption (%)	Fired bulk density (lb./cu. in.)	Total shrinkage (%)	Absorption (%)
4*C* 500	0.0711	0.98	13.63	0.0730	1.47	12.51
4*C* 1500	0.0757	0.92	9.42	0.0761	1.07	9.27
4*C* 3500	0.0785	1.05	7.72	0.0792	1.24	6.43
4*F* 500	0.0693	2.08	13.79	0.0715	2.66	12.33
4*F* 1500	0.0772	2.58	8.64	0.0776	2.44	8.51
4*F* 3500	0.0806	2.28	7.53	0.0783	2.05	7.23
7*C* 500	0.0742	2.34	10.42	0.0755	1.73	10.19
7*C* 1500	0.0784	2.51	8.37	0.0778	1.84	8.74
7*C* 3500	0.0787	2.51	8.14	0.0781	1.97	8.46
7*F* 500	0.0729	2.72	11.84	0.0713	2.39	12.08
7*F* 1500	0.0759	2.48	8.15	0.0766	1.76	8.62
7*F* 3500	0.0780	2.34	8.24	0.0781	2.01	7.83

Average fired bulk density of stiff-mud brick: 0.0724 lb./cu. in.
Average absorption of stiff-mud brick: 8.03%.
Average total shrinkage of stiff-mud brick: 6.25%.

With both variations of grind and moisture content, pressure cracking was produced at a forming pressure of 3500 pounds per square inch with the plastic clay. The sandy clay, however, cracked only when ground through 20-mesh and tempered with 7% moisture. The application of a vacuum to the mold box eliminated cracking in all the variations.

The plastic fireclay brick were fired in a muffle tunnel kiln. The firing schedule for these brick was approximately four days. The firing temperature varied from cone 6 to cone 7.

The sandy fireclay brick were fired in a round downdraft kiln, fired with fuel oil. The brick were set in the center of the kiln in the bottom, middle, and top courses to assure results com-

parable with the firing normally received by the stiff-mud brick. The firing schedule was six days. The variation in temperature throughout the ware was from cone 5 to cone 7.

III. Properties of Fired Ware

The physical properties of the fired brick are given in Tables II and III.

IV. Appearance of the Fired Ware

(1) Effect of Fineness Optimum results with plastic fire clay were obtained by grinding a clay through a 14-mesh sieve tempering to a 7% moisture content and using

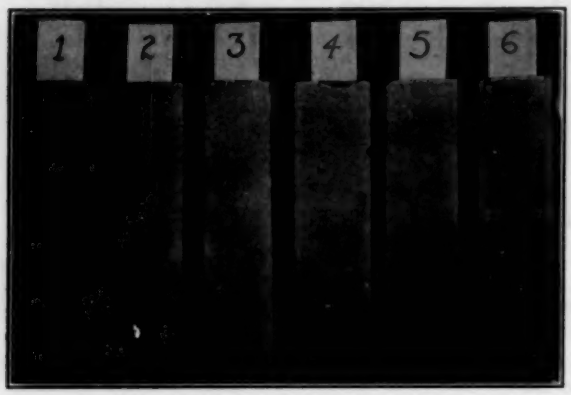

FIG. 1.—Brick made from plastic fire clay, *P*, tempered with 7% moisture, showing effect of grind and moisture.

No.	Grind (mesh)	Forming pressure (lb./sq. in.)
1	14	500
2	14	1500
3	14	3500
4	20	500
5	20	1500
6	20	3500

1500 pounds per square inch forming pressure. If the clay was ground to pass a 20-mesh sieve it was necessary to use an evacuated mold box to obtain good brick free from pressure cracks.

Optimum results with the sandy fire clay were obtained by grinding the clay through a 20-mesh sieve tempering to a 4% moisture content and using a forming pressure of 3500 pounds per square inch. If a higher moisture content (7%) was used, it was necessary to use an evacuated mold box to eliminate pressure cracking.

(2) Effect of Moisture Low-moisture content (4%) produced brick with poor edges compared to brick made from clay tempered with 7% moisture content, but pressure cracking was also lessened at the low-moisture content.

(3) Effect of Pressure Increasing the forming pressure increased the amount of lamination, the bulk density, and the total shrinkage. It also decreased the absorption, pinholing, and edge cracking, the last of which developed in low-density brick. High forming pressures gave brick with opposite edges of nearly equal density and consequently equal resistance to abrasion from handling. As can be seen in the figures this defect was very noticeable on the brick formed at low pressures. This difference in the density of the two opposite faces could be overcome if the pressure were

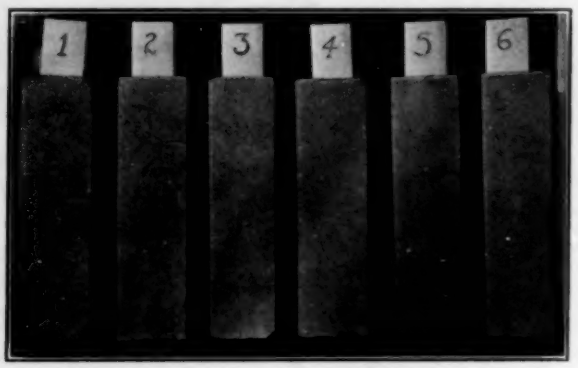

FIG. 2.—Brick made from sandy fire clay, *S*, tempered with 4% moisture.

No.	Grind (mesh)	Forming pressure (lb./sq. in.)
1	14	500
2	14	1500
3	14	3500
4	20	500
5	20	1500
6	20	3500

applied from two directions instead of one direction as was the case in the press used in this investigation.

(4) Effect of Evacuation The effect of evacuation in all cases lessens the severity of pressure cracking and in some cases eliminates cracking entirely. The main benefit accruing from the use of vacuum is to widen the range of permissible moisture content at high pressure.

V. Resistance to Crazing

The resistance of the brick to crazing was determined by the autoclave treatment. The time limit was determined by subjecting stiff-

mud glazed brick to 150 pounds per square inch pressure for increasing intervals of time.

Brick from both clays developed crazing when the time of testing was over 100 minutes.

Considerable difficulty was encountered in obtaining the requisite steam pressure at a uniform rate. More speed was required than was obtained in using the type of autoclave recommended by Schurecht.[1] Consequently the autoclave was altered as shown in Figure 4. With this altered autoclave it is possible to obtain a pressure of 150 pounds per square inch in ten minutes. No appreciable difference in severity of crazing was noticed by using this accelerated method of reaching the operating pressure.

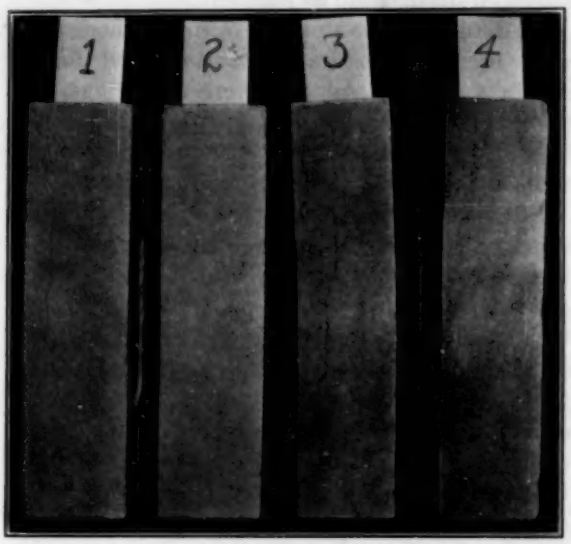

FIG. 3.—Effect of evacuation on brick pressed at high pressures.

No.	Forming pressure (lb./sq. in.)	Mold box	Clay
1	3500	Normal	Plastic
2	3500	Evacuated	"
3	3500	Normal	Sandy
4	3500	Evacuated	"

The results of the autoclave tests indicate that the forming conditions necessary to produce dry-press brick equal to stiff-mud brick in appearance also produced brick equal to them in resistance to crazing when subjected to autoclave treatment.

VI. Conclusions

(1) Dry-press brick made under the most favorable conditions are equal to stiff-mud brick in appearance and in ability to withstand crazing as produced in the autoclave tests.

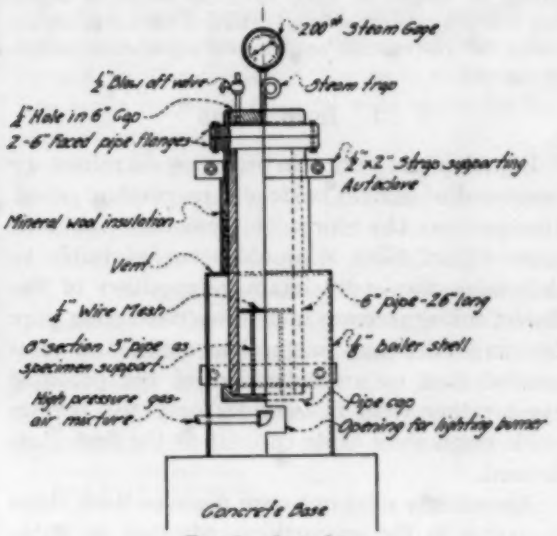

FIG. 4.—Autoclave.

(2) Such defects as pinholing and crawling are decreased or eliminated by fine grinding and high forming pressures.

(3) No cupping of the face was noted in any of the dry-press brick.

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[1] H. G. Schurecht, "Methods of Testing Crazing of Glazes Caused by Increase in Size of Ceramic Bodies," *Jour. Amer. Ceram. Soc.*, **11** [5], 271–77 (1928).

APPROXIMATE COMPOSITION OF THE LOWEST FUSING MIXTURE OF BARIUM OXIDE, MAGNESIUM OXIDE, AND SILICA*

By Cecil H. Turner

ABSTRACT

Varying mixtures of BaO, MgO, and SiO_2 were made into cones and fired to determine the temperature at which they would fuse. The direction of falling temperature as determined by their relative fusion temperatures converged to an area whose center represented a mixture, the composition of which was approximately 46.0% by weight of BaO, 8.0% by weight of MgO, and 46.0% by weight of SiO_2. The first signs of fusion occurred in this mixture at standard pyrometric cone 1 (3 o'clock).

I. Introduction

Experimental work is in progress on a refractory composed of barium oxide and magnesium oxide. Inasmuch as the source of these materials contains 4% of silica it would seem advisable to determine the approximate composition of the lowest fusing mixture in a series containing pure barium oxide, pure magnesium oxide, and commerical flint as an indication of the probable bond rather than to consider only the barium oxide-magnesium oxide eutectic as the first glass formed.

Accordingly mixtures were made of these three materials in the proportions indicated in Table I. The materials were ground to pass a No. 200 Tyler sieve and were bonded into cones with gum tragacanth.

The cones were set in cone plaques made from a mixture of 80% alumina and 20% Florida kaolin and fired in a small gas-fired pot furnace. The fusion temperatures were checked by repeating the test in a larger downdraft gas-fired test kiln using thermocouples.

II. Procedure

A triaxial was drawn with BaO, MgO, and SiO_2 as the end members. Lines were then drawn between the lowest recognized eutectics on each side of the triaxial as shown in the diagram. Points placed on these lines at regular intervals gave a uniform variation of composition in the test mixtures to be fired. Only those mixtures on which an end point was obtained are shown on the diagram by number.

To determine the accuracy of the methods that were used in mixture preparation and firing, mixtures of BaO and SiO_2 were tested and the lowest fusing mixture was found to be within 0.5% of the composition of the previously established eutectic, tridymite–$BaO{\cdot}2SiO_2$.

Alternating the test mixtures with standard cones and placing them in a fused-quartz protecting ring in a straight line normal to the direction of flame travel was found to give a temperature variation that would not exceed the accuracy required by the test. The temperatures given in the table were calculated from the deformation of standard pyrometric cones taken at the time the first evidence of fusion appeared in the test mixture with allowance made for the rate of heating. These were later checked with the aid of a thermocouple.

III. Results

Table I

Mixture No.	BaO (% by wt.)	MgO (% by wt.)	SiO_2 (% by wt.)	Standard cone	Temp. (°C)
5	47.5	52.5	00.0	14^3	1380
12	38.0	7.0	55.0	5^4	1225
13	34.0	10.0	56.0	5^4	1225
14	30.0	13.0	57.0	5^4	1225
21	59.0	5.0	36.0	3^1	1210
22	57.5	4.5	38.0	3^1	1210
23	56.0	4.0	40.0	3^1	1210
32	30.0	29.0	41.0	7^2	1255
39	50.0	6.0	44.0	1^3	1120
42	46.0	6.0	48.0	1^3	1120
43	46.0	8.0	46.0	1^3	1115
44	46.0	10.0	44.0	1^3	1120
48	42.0	10.0	48.0	1^3	1120

It was difficult to determine the difference in fusion temperature between members 12, 13, and 14. All three were included as a low melting range in the series. Mixture 13 showed the most evidence of fusion.

Mixtures numbered 21 to 23 all appeared to start at standard cone 3^1 and all three were included in the series, although mixture 22 showed the most evidence of fusion of the three.

In the mixtures higher in magnesia and barium a heating during mixing and forming was observed that was ascribed to a hydration reaction of the

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These data were condensed from a thesis presented for the Degree of Bachelor of Ceramic Engineering at Ohio State University, December, 1933, under the direction of A. S. Watts.

barium oxide since it was not evident in the mixtures high in magnesia and low in barium. Mixtures 31 and 32 showed the first signs of fusion at standard cone 7½.

Members 39, 42, 43, 44, and 48 all showed

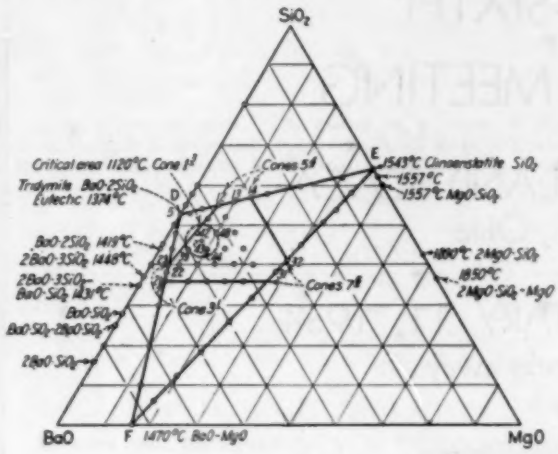

FIG. 1.

evidence of fusion at standard cone 1½. Greater evidence of fusion in member 43 indicated either a more rapid melting or a fusion at a slightly lower temperature than the surrounding mixtures that was not detected in the test. This member was concluded to fuse first at 1115°C.

IV. Conclusions

The major conclusion arrived at from the results of this test is that the addition of silica to the simple BaO–MgO system will bring about the formation of a glassy phase which might serve as a bond at a temperature much lower than that at which the BaO–MgO eutectic would occur. A microscopic investigation of the fused cone tips would undoubtedly reveal valuable information regarding the nature of the glass formed in this system. No such examination was made although the tips were saved for further investigation.

Due to the large per cent of silica in the lowest fusing mixture and to the fact that the amount of silica that would be introduced as an impurity in commercial manufacture would not exceed 4% it was concluded that the amount of glass formed below the temperature of the BaO–MgO eutectic would be small. Calculation from the approximate composition of the lowest fusing mixture showed this amount of glass to be approximately 10.0%.

CERAMIC DEPARTMENT
OHIO STATE UNIVERSITY
COLUMBUS, OHIO

American Ceramic Society

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Tuesday Evening: Edward Orton, Jr., Lecture by Dr. Arthur L. Day, Sponsored by the Fellows of the American Ceramic Society

Wednesday Forenoon and Afternoon: Eight Divisions in Simultaneous Sessions

Wednesday Evening: General Supper and Entertainment

Thursday: Symposium on Thermal Conductivity
Plant Excursions to Armco and Frigidaire Plants

Thursday Evening: Lecture by Dr. George Morey, "Glass: the Bond in Ceramics"

Friday: General Excursion to Louisville Plants—All Divisions Interested

CERAMIC ABSTRACTS[1]

Compiled by the

AMERICAN CERAMIC SOCIETY

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Vol. 13 **January, 1934** **No. 1**

Abrasives

Abrasive grain sizes studied. V. V. De Sveshnikoff. *Abrasive Ind.*, **14** [10], 9 (1933).—An experiment by the Bureau of Standards to check particle diameter distribution is described and its results are given. Illustrated. See also *Ceram. Abs.*, **10** [4], 243 (1931). C.H.T.

Plastic abrasive material for floor coatings. General Abrasive Co. *Metal Cleaning & Finishing*, **5** [8], 350 (1933).—Plastic Fut-Sure, a nonslip floor covering, is made of hard aluminum oxide abrasive grains and a special binder, both being waterproof. The material is oil and grease proof, resistant to acids and alkalis, a nonconductor of electricity, heat and cold resisting, and is easily cleaned. E.J.V.

Ground-glass junctions. H. L. Baumbach. *Ind. Eng. Chem., Anal. Ed.*, **5** [5], 349 (1933).—The grinding of ground-glass junctions is described and illustrated. F.G.H.

Production of shell reamers. Fred B. Jacobs. *Abrasive Ind.*, **14** [10], 12 (1933).—Special grinding fixtures used in making shell reamers on a quantity basis are described. Illustrated. C.H.T.

Grinding aids motor progress. Edward S. Heck. *Abrasive Ind.*, **14** [10], 6 (1933).—The necessity for accuracy in producing free-wheeling mechanism and dual-ratio transmission is discussed and methods of obtaining it by grinding are described. Illustrated. C.H.T.

Special polishing and buffing machine. Mitchell Engineering Co. *Metal Cleaning & Finishing*, **5** [8], 347–48 (1933).—Illustrated. E.J.V.

Two-wheel set-up used. Anon. *Abrasive Ind.*, **14** [10], 21 (1933).—An internal grinder that roughs and finishes and a possible method for the removal of large amounts of stock with exceptionally fine finish are described. Illustrated. C.H.T.

Flat grinding machines. V. Carl Morey. *Abrasive Ind.*, **14** [10], 10 (1933).—Disk grinding is discussed and disk grinders for special purposes are described. Illustrated. For Parts I–IV see *Ceram. Abs.*, **12** [10–11], 347 (1933). C.H.T.

Portable grinder. Black and Decker Mfg. Co. *Foundry*, **61** [3], 68 (1933).—A portable electric bench grinder having two 6-inch grinding wheels is described. F.G.H.

Bulletin

Polishing wheels. Cleveland Container Co. Reviewed in *Foundry*, **61** [5], 62; [7], 79 (1933).—This bulletin discusses the industrial applications of abrasive sleeves and expanding polishing wheels. F.G.H.

Patents

Safety device for grinding machines. H. E. Balsiger (Landis Tool Co.). U. S. 18,986, Oct. 31, 1933 (reissue).

Automatic lapping machine. H. J. Wills (Carborundum Co.). U. S. 19,003, Nov. 14, 1933 (reissue).

Apparatus and process of making abrasive tools. O. S. Buckner. U. S. 1,930,788, Oct. 17, 1933.

Grinding machine. Owen Doutt (General Spring Bumper Corp.). U. S. 1,931,106, Oct. 17, 1933. H. G. Weinland (Safety Grinding Wheel & Machine Co.). U. S. 1,932,260, Oct. 24, 1933. G. W. Binns (Cincinnati Grinders, Inc.). U. S. 1,932,952, Oct. 31, 1933. C. W. Hopkins and J. E. Caster (Cincinnati Grinders, Inc.). U. S. 1,932,969, Oct. 31, 1933. H. K. Tegarden (Cincinnati Grinders, Inc.). U. S. 1,932,993, Oct. 31, 1933. C. T. Raule. U. S. 1,933,028, Oct. 31, 1933. W. J. Guild (Heald Machine Co.). U. S. 1,933,213, Oct. 31, 1933. L. J. Bazzoni (United Shoe Machinery Corp.). U. S. 1,933,581, Nov. 7, 1933. H. B. Moore. U. S. 1,933,677, Nov. 7, 1933. F. V. Geier and F. S. Haas (Heald Machine Co.). U. S. 1,934,601, Nov. 7, 1933. H. Q. Munn (Du-More Tap and Tool Co.). U. S. 1,935,328, Nov. 14, 1933.

Grinding wheel. Everard Stubbs (Norton Co.).

[1] The bold-face number following the journal is the volume, the issue number is in brackets, followed by the page numbers, then the year in parentheses.

U. S. 1,931,363, Oct. 17, 1933. F. J. Tone and M. L. Hartmann (Carborundum Co.). U. S. 1,935,103, Nov. 14, 1933.

Grinding, polishing, lapping, and finishing of metals. J. N. Bethel (Norton Co.). U. S. 1,931,370, Oct. 17, 1933.

Buffing or polishing machine. F. W. Lovett (Porter McLeod Machine Tool Co., Inc.). U. S. 1,931,500, Oct. 24, 1933.

Method of grinding cutters. F. J. Aker (Eastern Cutter Salvage Corp.). U. S. 1,931,684, Oct. 24, 1933.

Cylinder hone. W. E. Heuer (Hall Mfg. Co.). U. S. 1,931,986, Oct. 24, 1933.

Abrasive article and method of making. S. F. Hepp. U. S. 1,932,104, Oct. 24, 1933. An abrasive article is formed of a mixture containing finely divided abrasive material and polymerized chloroprene.

Surfacing apparatus. P. J. M. Escole (Forges et ateliers de constructions électriques de Jeumont). U. S. 1,932,305, Oct. 24, 1933.

Surface grinding machine. H. L. Myers (American Floor Surfacing Machine Co.). U. S. 1,932,319, Oct. 24, 1933.

Machine for grinding springs. R. A. Herckelbout. U. S. 1,932,893, Oct. 31, 1933.

Grinding compound filter and method of operation. R. A. Walters and N. A. Sorenson. U. S. 1,932,996, Oct. 31, 1933.

Valve grinder. J. O. Huse. U. S. 1,933,016, Oct. 31, 1933.

Machine for grinding or polishing cutlery. A. V. Hague, Jr. U. S. 1,933,055, Oct. 31, 1933.

Grinding and lapping machine. W. F. Fraser (Norton Co.). U. S. 1,933,373, Oct. 31, 1933.

Leather buffing machine. R. E. Duplessis (United Shoe Machinery Corp.). U. S. 1,933,665, Nov. 7, 1933.

Abrading tool. W. A. Reed (United Shoe Machinery Corp.). U. S. 1,933,685, Nov. 7, 1933.

Doctor blade for rolls, cylinders, etc. O. P. Arnold (W. E. Greene Corp.). U. S. 1,933,837, Nov. 7, 1933.

Hob grinder. C. G. Olson (Illinois Tool Works). U. S. 1,933,872, Nov. 7, 1933.

Grinding or honing machine. B. O. Isom (Hutto Engineering Co., Inc.). U. S. 1,934,858, Nov. 14, 1933.

Method and means for shaping and truing the operating surface of grinding wheels used for form grinding. S. J. Harley. Brit. 398,841, Oct. 4, 1933.

Method and apparatus for abrasive cutting of work. Industries of America. Brit. 398,976, Oct. 4, 1933.

Corrugated cutters for dressing grinding wheels. A. Lebert. Brit. 399,163, Oct. 11, 1933.

Method of introducing cylindrical blanks into a grinding machine. C. Thyssen. Brit. 399,444, Oct. 11, 1933.

Device for truing and dressing abrasive wheels. C. M. Linley. Brit. 399,576, Oct. 18, 1933.

Form grinding. S. J. Harley. Brit. 400,212, Nov. 1, 1933.

Art and Archeology

Measuring color in the ceramic industry. F. H. Norton. *Ceram. Age*, **21** [5], 131 (1933).—N. discusses the definition of color. Heretofore color has been measured by comparison with a certain standard. A more scientific means consists in measuring the amount of each wavelength of light reflected from it when illuminated from a standard source. A recording photoelectric color analyzer will automatically plot a color curve showing these measurements in less than a minute. Color can also be conveniently specified by three independent attributes called dominant wave-length, reflecting power, and purity. A schematic method for the representation of these factors is described and illustrated. Various ceramic colors are considered and the following factors affecting glaze color variation are briefly discussed: (1) concentration of coloring material, (2) thickness of glaze, (3) composition of base glaze, (4) composition of body, (5) time and temperature of firing, and (6) kiln atmosphere. Illustrated with curves and sketches. F.G.H.

Production and firing of enameled products. Albert Granger. *Céram. Verrerie*, No. 844, pp. 533–37; No. 845, pp. 579–602 (1932); *Céram., Verrerie, Email.*, No. 1, pp. 5–7; No. 2, pp. 57–58; No. 3, pp. 113–16 (1933).—G. discusses in detail the production and firing of enameled products including (1) clays used, giving their composition and limits of purity; (2) preparation and casting of the slip, emphasizing the need for correct specific gravity of the slip; (3) preparation and application of engobes and glazes with a detailed discussion of colorants and opacifiers; and (4) drying and firing of the products Several typical industrial formulas are given. See also *Ceram. Abs.*, **12** [8], 302 (1933). M.H.B.

Nonmetal constituents of bright gold. I–II. Akira Nakatsuchi. *Jour. Soc. Chem. Ind.* [Japan], **36** [4], 171–72*B*; [9], 524–25*B* (1933).—The influence of different resins and impurities on bright gold is discussed. M.V.K.

Contribution to the manufacture of luminous colors. L. Vanino and S. Rothschild. *Sprechsaal*, **66** [36], 611–12 (1933).—A good luminous color must (1) be sensitive to weak sources of light, (2) possess a good illuminating power, and (3) have a lasting luminosity. Such colors are produced from alkaline-earth sulfides with admixtures of traces of metals and a subsequent calcining (at least 800°) in the presence of suitable fluxes. Pure sulfur in some cases behaves better than "sulfur depuratum." "Calcium oxydatum e marmore," strontium oxide, strontium hydroxide, and strontium carbonate, barium oxide and barium carbonate, and additions of magnesium oxide are used as a foundation for the alkaline-earth phosphorus. Thiosulfate of alkaline earth is also used. Alkaline salts, especially lithium salts, are shown to be the most suitable fluxes. Small amounts of salts of bismuth, copper, rare earth, etc., are added to the mixture. The best results are obtained with bismuth. Directions for preparing lumin-

ous colors and the compositions of violet, blue, green-blue, red, and yellow colors are given. M.V.K.

Yellow etching. LUDWIG SPRINGER. *Sprechsaal*, **65** [10], 179 (1932).—Comments are presented on the discussion of R. Schatt (*Ceram. Abs.*, **11** [6], 355 (1932)) dealing with the yellow etching of glass. M.V.K.

Pleasing women by means of color. M. L. HULL. *Bull. Amer. Ceram. Soc.*, **12** [11], 314–17 (1933).

Summer china and glass. ANON. *Amer. Home*, **10** [1], 10–11 (1933).—Two pages of new china and glassware designs are described and illustrated. F.G.H.

History of the ceramic industry. I–II. R. D. *Rev. belge ind. verrières, céram., émail.*, **4** [7], 151–52; [8], 177–79 (1933).—After explaining the word "ceramic" and classifying the different kinds of potteries according to Brongniart, D. describes antique Oriental pottery, antique American (Mexico and Peru) pottery, Egyptian, Greek, Roman, Middle Ages, Renaissance, Hispano-Moresque, French, faience of Henry II, works of Bernard Palissy, and the faience of Nevers, Rouen, and Delft. M.V.K.

Samuel Pepys' trade-cards. AMBROSE HEAL. *Connoisseur*, **92** [385], 165–71 (1933).—From a collection of prints called Vulgaria by Samuel Pepys an interesting trade-card is described which shows the glassblower demonstrating his craft to a distinguished visitor. Illustrated. E.B.H.

German porcelain of the Bavarian National Museum. MICHAEL BIRKENBIHL. *Sprechsaal*, **66** [31], 523–25 (1933).—Porcelain objects of the 18th Century are described. Illustrated. M.V.K.

Early Greek art in the Gulf of Corinth. H. G. G. PAYNE. *Illus. London News*, **183**, 65–67 (1933).—The British School's third campaign at Perachora has yielded a temple of Hera Limenia (Protectress of the Harbor) and a remarkable series of clay and bronze objects. Illustrated. See also *Ceram. Abs.*, **12** [2], 44 (1933). H.H.S.

Ancient Indian jars restored. ANON. *Popular Sci. Monthly*, **120** [3], 60 (1932).—The restoration of ancient pottery is described and illustrated. F.G.H.

Vitrified pottery dug up in Mexico shows horses of Spanish conqueror. ANON. *Christian Sci. Mon.*, **25** [238], 5 (1933).—The finding of samples of vitrified pottery in the subsoil of Mexico City's main plaza has led scholars of pre-Hispanic history to new conjectures on migrations of the Toltec tribes who finally settled in the Valley of Mexico. Figures of horses and riders are found in the decorations so that the ware is evidently a product following the arrival of the Spaniards. As the pottery is identical to some found in regions farther south it is thought that it was produced by Toltecs rather than Aztecs. It is believed that the Toltecs learned the technique of glazed pottery on one of their migrations into what is now Guatemala and Salvador. E.J.V.

Tell Asmer excavations. HENRY FRANKFORT. *Illus. London News*, **183**, 97–101 (1933).—The Chicago Univ. expedition to Iraq has made important discoveries in the ruins of the Akkadian City of Eshnunna, capital of King Sargon in 2500 B.C. Illustrations in color. H.H.S.

Jewish prototypes of early Christian art at Dura-Europos. CLARK HOPKINS. *Illus. London News*, **183**, 188–91 (1933).—Remarkable discoveries by the Yale expedition at Dura-Europos necessitate a reëxamination of the whole question of origins of early Christian art. 22 illustrations. See also *Ceram. Abs.*, **12** [1], 5 (1933). H.H.S.

Patina of ancient stained glass. ANON. *Diamant*, **55** [25], 291–92 (1933).—A discussion of the origin of patina on stained glass and the opinions of different investigators are given. M.V.K.

Clay sculpture of Saxony. ALBERT SCHRÖDER. *Sprechsaal*, **66** [33], 555–56 (1933).—Sculptures of the 15th, 16th, and 17th Centuries shown at the Leipzig State Museum are described. Illustrated. M.V.K.

Predynastic Egyptian pottery. O. H. MYERS. *Illus. London News*, **183**, 246–47 (1933).—The cemetery of the sacred bull, Buchis, at Armant has yielded clay models of bulls, painted stoneware, glazed quartz beads, etc. Illustrated. H.H.S.

Excavating the Biblical city of Lachish. E. N. FALLAIZE. *Discovery*, **14**, 228–31 (1933).—The Wellcome-Colt expedition at Tell Duweir in Southern Palestine tentatively identifies the site with Lachish. Mycenean pottery of 1260 B.C. was found. H.H.S.

The Calakmul expedition. S. G. MORLEY. *Scientific Monthly*, **37**, 193–206 (1933).—The gap between the regions of the Maya Old Empire in Guatemala and the New Empire in Yucatan has been filled by the Carnegie Institute's discovery of a definitely Old Empire city as far north as Calakmul in Campeche. H.H.S.

BOOKS

The Flowing Vase and the God with Streams. E. D. VAN BUREN. xvi + 150 pp., 23 plates. Hans Schoetz & Co., Berlin, 1933. Reviewed in *Times Lit. Supp.*, **32**, 497 (1933).—The early Mesopotamian deity who holds a pot or has streams of water flowing from his shoulders and breast is discussed. H.H.S.

Early Civilization in Thessaly. HAZEL D. HANSEN. xix + 203 pp. Johns Hopkins Press, Baltimore, 1933. Price $6.00. Reviewed in *Times Lit. Supp.*, **32**, 560 (1933). H.H.S.

PATENTS

Design for tumbler. I. M. CLARKE (New Martinsville Glass Mfg. Co.). U. S. 90,869, Oct. 17, 1933.

Design for goblet. J. C. ROSENMERKLE (Fostoria Glass Co.). U. S. 90,928, Oct. 24, 1933.

Design for jar. J. S. ALGEO (Hazel-Atlas Glass Co.). U. S. 90,934, Oct. 31, 1933.

Design for panel. A. A. JABLIN (Davidson Enamel Products, Inc.). U. S. 90,949, Oct. 31, 1933.

Design for lamp base, etc. C. B. ILGENFRITZ (U. S. Glass Co.). U. S. 91,030, Nov. 14, 1933.

Design for bottle. F. T. KESSLER (Continental Distilling Corp.). U. S. 91,033, Nov. 14, 1933.

Manufacture and production of ceramic transfers. L. ALLEN AND JOHNSON, MATTHEY, & CO., LTD. Brit. 399,922, Oct. 25, 1933.

Cements

Swelling of lime and its meaning for the building industry. W. DAWIHL. *Tonind.-Ztg.*, **57** [82], 963–64; [84], 988–90 (1933).—Experiments with four typical limes demonstrated that slaked lime shows fine grains of great uniformity. This uniformity explains the valuable properties of this product for the building industry. W.M.C.

Story of cement. OLIVER BOWLES AND H. HERBERT HUGHES. *Can. Mining Met. Bull.*, No. 259, pp. 525–36 (1933). G.M.H.

Development and use of a Canadian plastic magnesia. A. F. GILL. *Can. Chem. Met.*, **17** [10], 200–203 (1933).—The occurrence of magnesium minerals in Canada, work of the National Research Council on magnesite, the problem of hydration, calcination tests, and the use of magnesia as a flooring material are discussed. Illustrated. E.J.V.

Drying slurry in the cement industry. ANON. *Tonind.-Ztg.*, **57** [75], 879–82; [77], 904–906; [79], 929–31 (1933).—This is a symposium of methods used by different companies. Zollikofer makes use of chain curtains in the upper part of rotary kilns. The slurry is sprayed against the chains under a pressure of 6 to 8 atmospheres. Special membrane pumps have been developed for this purpose. Göntgen uses a special drying apparatus through which the material is passed before entering the rotary kiln. This "calcinator" is heated by means of waste heat from the kiln. Schmid uses chains arranged in the preheating zone of the kiln and special waste-heat driers for the slurry. The heat economy of these kilns is much greater than that of ordinary kilns. Goebel also uses chains arranged between two concentric cylinders. Slurry and waste heat move in opposite directions. Manger removes the surplus water by means of filtration. Different types of machinery are presented including vacuum filters of disk shape, etc. All the installations have been tested in actual plant work with different companies. W.M.C.

PATENTS

Process of calcining gypsum. W. S. RANDEL AND M. C. DAILEY (U. S. Gypsum Co.). U. S. 1,931,240, Oct. 17, 1933.

Process of making permeable ceramic products. W. L. STAFFORD (Johns-Manville Corp.). U. S. 1,934,383, Nov. 7, 1933.

Enamel

Manufacturing defects and mechanical damages in wet-process porcelain enamelware. EDWARD DAHILL. *Bull. Amer. Ceram. Soc.*, **12** [11], 317–18 (1933).

Gas phase in enamel. ANON. *Keram. Rund.*, **41** [15], 191–92 (1933).—Gas development and gas inclusions play an important rôle in enamels, and microscopic gas inclusions are important when opacifying enamel. Coagulation phenomena appearing in the enamel may cause the formation of large gas bubbles. The observations of R. M. King are discussed. M.V.K.

Tin oxide as opacifier. ANON. *Keram. Rund.*, **41** [16], 199–200 (1933).—Opacification, the chief requirements for obtaining a satisfactory opacification, and tin oxide as an opacifier are discussed. See also article by Sasse, *Ceram. Abs.*, **12** [12], 414 (1933). M.V.K.

Majolica enameling according to the wet and powder methods. LANG. *Glashütte*, **63** [12], 204–206 (1933).—The usual methods are described in detail. Antimony (2 to 4%) is the best opacifier for the ground enamel; attemps to use tin oxide were unsatisfactory as it produced bubbles and dark spots in the majolica enamel. Antimony increased the adherance of the ground. Fluorides should not be used in the composition of the ground enamel. M.V.K.

Ground-coat studies. II: Temperature and consistency. E. P. CZOLGOS. *Better Enameling*, **4** [10], 18–19 (1933).—A study over a period of several days showed that enamel aged at 68 to 70°F retained good smooth draining properties longer than enamel aged at 75–87°F. It was found that as the ground-coat enamel begins to lose set a decrease in water content is necessary in order that the consistency of the enamel may be adjusted and the enamel will drain at a given amount per square foot. Another study covering the change in consistency of the enamel caused by variations in temperature during a period of 3 to 4 hrs. showed that distinct advantages are to be derived through control of ground-coat enamel temperature during the dipping process. Illustrated. For Part I see *Ceram. Abs.*, **12** [12], 414 (1933). E.J.V.

Bursting of enamel. V. *Emailwaren-Ind.*, **10** [34], 271–73 (1933).—A detailed discussion is given of reasons for cracking of enameled objects. The distribution of stresses in enameled ware of different shape is described and illustrated in a diagram. M.V.K.

Enameled cast iron in nitrogen atmosphere. ANON. *Ceram. Ind.*, **21** [3], 113 (1933).—Tests of enameled cast-iron pieces showed that irons which blister in normal atmospheres do not blister in an atmosphere of nitrogen. Other tests indicate that blistering is associated with the oxidation of carbon in a particular state in certain irons. E.J.V.

Factors affecting the porcelain enameling of cast iron. ANON. *Enamelist*, **10** [12], 9–12 (1933). E.J.V.

Significance of analysis with regard to the capability of enameling of cast iron. A. KRÄUTLE. *Sprechsaal*, **66** [15], 252 (1933).—The effect of the analysis on the strength, coefficient of expansion, and the surface structure of the cast iron was investigated. Among the more or less undesirable elements of the cast iron (carbon, silicon, manganese, phosphorus, and sulfur), carbon may be considered as a constant quantity. The carbon content usually amounts to 3.2 to 3.5%. The other components should be considered as variable. The phosphorus content may vary between 0.6 and 1.3%; it promotes a good cast iron. The normal content of silicon is 2.2 to 2.6%;

it promotes the separation of graphite in contrast with Mn and S and favors the destruction of iron and other carbides. From 0.4 to 0.6% Mn is sufficient to combine S. S is quantitatively combined with Mn and should not amount to more than 0.8 or 0.11%. The relationship between the analysis and coefficient of expansion is almost unexplainable because a series of factors, such as overheating, thickness of walls, casting temperature, and rate of cooling, considerably complicates it. Pretreatment of the iron by calcining and repeated enameling (ground, intermediate, and covering enamel) lowers the coefficient of expansion. A white hardened cast iron has a higher coefficient of expansion than a gray hardened one. The nature of the surface to be enameled is of the greatest importance. The formation of graphite is not of such great importance with respect to the formation of bubbles. The surface of the iron consists of a fine layer of carbide iron which accounts for the formation of bubbles and needle tappings in many cases. A perlitic structure is difficult to enamel. The same is true of cast iron containing 1 to 2% FeO. The iron is reduced by the free carbon, and the CO or CO_2 formed promotes bubbles. M.V.K.

Temperatures of steel and slag in basic open-hearth furnaces. E. SCHRÖDER. *Stahl & Eisen*, **53** [34], 873–74 (1933); *Arch. Eisenhüttenwesen*, **7**, 157–64 (1933).—Optical and thermoelectric temperature measurements were carried out. Corrections were determined for radiation properties of molten steel and slag. Temperature curves were measured over the entire melting period, in the furnace crown, at the surface of the melt, and in different depths of the melt. The influence was studied of additions of ore, lime, and manganese to the melt. The heat of reaction was calculated taking into account the temperature gradient between slag and steel. A list of pouring temperatures is presented depending on the carbon content of the melt. The pouring temperature should range from 100 to 150°C above the melting temperature. W.M.C.

Understanding of enamel adherence. R. ALDINGER. *Ceram. Age*, **21** [6], 163–65 (1933); for abstract see *Ceram. Abs.*, **12** [10–11], 355 (1933). F.G.H.

Coefficient of expansion of porcelain enamel. ANON. *Amer. Enameler*, **6** [7], 4–6 (1933).—An outline of the interferometer method of determining the coefficient of expansion is given. Examples of the use of data so obtained in determining enamel fit and typical expansion curves for various enamels are given. Illustrated. E.J.V.

New ideas and finishes in enameling. CENTURY VITREOUS ENAMELING CO. *Ceram. Ind.*, **21** [4], 168–69 (1933).—An unusual effect in strong high-lights and shadows is secured by a raised finish which gives a pleasing double tone in any color combination. Illustrated. E.J.V.

Why not air-quenched enamels? C. E. MENGSHOL. *Ceram. Age*, **22** [3], 68–70 (1933).—Seven cast-iron enamels were tested to determine the comparative effects of air quenching and water quenching on the following enamel properties: (1) impact resistance, determined with a Paige impact machine, (2) modulus of rupture, and (3) load-bearing capacity of the enameled surface. The construction and operation of the air-cooling device for air quenching of the enamels are described and illustrated. Results do not indicate any marked superiority in either method. The greatest apparent advantage of the air-cooling treatment lies in the reduction of the milling time by at least 50%. F.G.H.

Dry-process enamel or wet? H. F. STALEY. *Ceram. Age*, **21** [4], 99–100 (1933). F.G.H.

Wet-process or dry-process enamels. M. G. COWMAN. *Ceram. Age*, **21** [2], 35–58 (1933). F.G.H.

Chief working methods and apparatus in enameling. ANON. *Sprechsaal*, **66** [35], 594–96 (1933).—Defects which are due to defective production methods, faulty raw ware, defective working of the enamel, and enamel composition and unexplained defects and fishscales are discussed in detail. M.V.K.

Making enameled cooking ware with gas. J. B. NEALEY. *Ceram. Age*, **21** [5], 139–41 (1933). F.G.H.

Melting enamel. ALDINGER. *Keram. Rund.*, **41** [8], 93–95 (1933).—To avoid defects the composition and grain size of the raw materials should be kept constant and intimately mixed. Directions for melting enamel are given. The physical properties of the enamel, *e.g.*, expansion, tensile strength, and resistance to pressure, are changed if the enamel is insufficiently fused or fused too long. M.V.K.

Speeding vitreous enameling. ANON. *Metal Cleaning & Finishing*, **5** [10], 422 (1933).—Grouping, conveying, and synchronizing units for speed and efficiency in the vitreous enameling process have been successfully accomplished in the finishing division of the Florence Stove Co., Kankakee, Ill. A description of the plant and equipment is given. E.J.V.

Sintering of the lining of rotary enamel kilns. KARMAUS. *Emailwaren-Ind.*, **10** [36], 285–87 (1933).—Directions for lining a rotary, oil-fired kiln for melting enamel and "glazing" the lining with waste enamel are given. M.V.K.

Oxygen in cast iron. WILLIAM F. CHUBB. *Metallurgia*, **8** [46], 125–26 (1933).—The problem of deoxidization of cast iron in regard to constitution and equilibrium conditions in iron carbon alloys is discussed. The general influence of oxygen upon physical and mechanical properties is considered, and methods available for deoxidization are given. M.V.K.

Cleaning metal parts for finishing. WILLIAM J. MISKELLA. *Metal Cleaning & Finishing*, **5** [7], 289–90 (1933).—A general discussion of the open tank and automatic cleaning machine methods of cleaning metal products is presented. Illustrated. E.J.V.

Composition and action of metal cleaners. E. K. STRACHEN. *Metal Cleaning & Finishing*, **5** [10], 426–29 (1933).—A practical discussion of the composition and action of metal cleaners in which S. cautions those who formulate their own cleaning compounds is presented. Various processes involved in the use of a metal cleaner are described. E.J.V.

Effects of pickling on the properties of carbon steel. I. G. SLATER. *Metal Cleaning & Finishing*, **5** [9], 389 (1933).—A study of the magnitude of the embrittling action produced in medium- and high-carbon steel on immersion in mineral acids of various concentrations and at different temperatures has been made using a simple

torsion test. Notched-bar impact tests on a series of plain carbon steels indicated that in several instances the steel had become toughened to a marked degree after chemical pickling in sulfuric acid or electrolytically as cathode. Tensile tests show that the properties of steels of the higher carbon contents undergo the greatest modification after pickling. A slight increase in the tensile strength was noted in all pickled specimens. A slight increase in the Brinell hardness was noted after electrolytic pickling. E.J.V.

Pickling of iron and steel and the action of inhibitors. ALLAN B. DOVE. *Can. Chem. Met.*, **17** [9], 192–94 (1933).—Scale does not form solely as a single layer (Fe_3O_4) but is rather of a triple construction (FeO, Fe_3O_4, and Fe_2O_3) in approximate amounts shown. Scale is removed in pickling mainly by the solution of the FeO layer and the dropping off of higher oxide layers. Pickling should be controlled chemically and thermally for efficient results in cost of operation and surface finish of product. Pickling influences the hardness of carbon steel. If uncontrolled, the induced surface hardness is appreciable and profoundly influences further working of the steel. Steels hardened and tempered within certain ranges of temperature may develop surface hardness and perhaps crack on deformation during later operations after pickling. E.J.V.

Temperature affects molding sand. S. O. V. NILSSON. *Foundry*, **61** [3], 10–44 (1933).—The expansion characteristics of the various silica minerals and some refractory clays are described. Several tests are introduced for determining the effect of thermal shock upon these materials. The changes effected in the physical properties of sand and clay molds by the introduction of hot metal and the various factors involved in the process are discussed in detail. Illustrations, curves, and sketches are included. F.G.H.

Controlling properties of cores. H. W. DIETERT AND F. VON VALTIER. *Foundry*, **61** [4], 18–50 (1933).—The control of the numerous factors affecting the physical properties of sand and clay cores is described and illustrated. F.G.H.

Fire clay for follow boards. P. DWYER. *Foundry*, **61** [6], 34–71 (1933).—The use of refractory clay for molds of small and intricate castings is described and illustrated in detail. F.G.H.

Bonding sand molds with cement. V. DELPORT. *Foundry*, **61** [6], 44–85 (1933).—Refractory molds in which molten metal is poured in the manufacture of castings may be made from siliceous materials, such as powdered refractory waste, and Portland cement. The cement is mixed with the siliceous material in the proportion of 15 parts by weight of cement to 100 parts of siliceous material. Setting takes place within 24 to 48 hours depending upon the size of the mold, the cement used, the amount of water used, and the degree of moisture in the atmosphere. F.G.H.

Latest in enamel patent literature. ANON. *Glashütte*, **63** [15], 256–58 (1933).—The article discusses European and American patents dealing with (1) production of opacifiers for enamels from materials such as zirconia containing titanium and iron as coloring impurities, (2) gas opacifiers, (3) enameling methods, (4) manufacturing enamel with high thermal and mechanical properties, (5) enameling copper utensils, (6) de-enameling, (7) enamel frits for enamels opacified white, (8) enamel coat for alloyed sheet iron, and (9) fusing enamel. M.V.K.

Waste in enamel works. H. MOTSCHAM. *Emailwaren-Ind.*, **10** [36], 287–90 (1933).—M. describes in detail the re-utilization of (1) waste enamel, (2) waste coat and ground enamel, (3) enamel dust and apparatus used for it, (4) different pickling solutions, (5) ashes from generator installations, (6) coal dust, (7) waste water, and (8) waste heat. M.V.K.

Clay and porcelain enamel used in renumbering program. ANON. *Ceram. Ind.*, **21** [3], 109–10 (1933).—Illustrated. E.J.V.

Bathtub bottoms. LOUIS WOLFF. *Ceram. Ind.*, **21** [3], 113 (1933). E.J.V.

Enameled house. V. *Emailwaren-Ind.*, **10** [33], 261–69 (1933).—American and German experiments with enameled houses are noted. Illustrated. M.V.K.

Telling the story of porcelain enamel. A. A. GRAY. *Better Enameling*, **4** [8], 10–12 (1933); see also article by Hodek, *Ceram. Abs.*, **12** [10–11], 359 (1933). E.J.V.

Republic Steel Corporation exhibit at Century of Progress. ANON. *Enamelist*, **10** [11], 21–22 (1933); see abstract entitled "Unusual exhibit at World's Fair," *Ceram. Abs.*, **12** [10–11], 359 (1933). E.J.V.

Store front of porcelain and aluminum. ANON. *Enamelist*, **10** [11], 11–12 (1933).—Kellog's Cafeteria in New York embodies porcelain enameled sheets with aluminum. Illustrated. E.J.V.

New trends in design and color for porcelain enameled products at 1933 Furniture Mart. ANON. *Enamelist*, **10** [11], 9–10 (1933).—Illustrated. E.J.V.

New vogue for moving picture theater design. BERNARD J. MCGARRY. *Enamelist*, **10** [11], 18–19 (1933).—A proposed small community center done in porcelain enamel is described, details of construction being given. Illustrated. E.J.V.

Care of plumbing equipment. LOUISE BARGELT. *Better Enameling*, **4** [8], 14 (1933); reprinted from *Chicago Sunday Tribune*, Aug. 6, 1933.—The proper care to be exercised in cleaning porcelain enameled plumbing fixtures is stressed, pointing out injurious effects possible with improper cleaning materials. E.J.V.

Walgreen at the Fair. ANON. *Better Enameling*, **4** [8], 6–7 (1933).—A porcelain enameled soda fountain at the Century of Progress is described. Illustrated. E.J.V.

Fabricated steel bathroom panels are steps toward factory-made house. ANON. *Ceram. Ind.*, **21** [3], 109 (1933).—Illustrated. E.J.V.

Porcelain enameling on sheet iron. GLENN A. HUTT. *Metal Cleaning & Finishing*, **5** [8], 343–44 (1933); for abstract see *Ceram. Abs.*, **12** [9], 323 (1933). E.J.V.

Glass-lined steel equipment in chemical industry. P. S. BARNES. *Ind. Eng. Chem.*, **25** [10], 1080–83 (1933).—Considerations which have occasioned the extensive use of glass-lined equipment by the chemical industries are presented. The term "glass-lined" refers to complex borosilicate enamels which fuse around 1800°F. The preparation of these enamels and the hot-dust and wet-spray methods of application to the steel shell are described.

Enameling furnaces and fuels used in their firing are discussed. Uses for many types of equipment are suggested, causes of failure are presented, and the reconditioning of old equipment is described. Illustrated. F.G.H.

Historical enamel batches for enameling iron. W. O. *Emailwaren-Ind.*, **10** [30], 240–41 (1933).—Several batches used in the 18th and 19th Centuries for enameling iron ware are discussed. M.V.K.

Researches on majolica enamels. Ks. *Glashütte*, **63** [18], 305–307; [19], 324–25 (1933).—The article deals with (1) a historical review, (2) properties of lead enamel, (3) poisonous enamel, and (4) dangers of manufacture. Attempts to replace a part of minium by barium carbonate in lead enamel are discussed. The best results were obtained with a batch consisting of 19.0 quartz, 14.0 borax, 37.0 minium, 7.0 soda, 2.0 saltpeter, 1.0 cryolite, and 17.4 barium carbonate. An increase of the borax or soda content lowers the stability of majolica enamels. M.V.K.

Accounting for porcelain enameled products. I. Purpose of cost accounting. CHARLES S. PEARCE. *Enamelist*, **11** [1], 9–12 (1933).—In outlining a uniform cost accounting system for porcelain enamel plants P. takes up the items to be considered in determining the factory cost of sales under the three divisions of direct material, direct labor, and overhead. E.J.V.

Porcelain enamel as a building material for ice cream plants. ANON. *Enamelist*, **11** [1], 21–23 (1933); reprinted from *Ice Cream Rev.*, Sept., 1933.—The possibilities of the use of porcelain enamel for ice cream plants are enumerated and it is unqualifiedly recommended. E.J.V.

Business adopts design. HENRY DREYFUSS. *Enamelist*, **11** [1], 19 (1933).—The restrictions and limitations imposed by materials upon the designer constitute a definite problem and greater freedom can be made possible only with the coöperation of manufacturers. The porcelain enameling industry has broadened the uses of its enamel. E.J.V.

Porcelain enamel has its day. ANON. *Ceram. Age*, **22** [2], 45 (1933).—A page of pictures depicting porcelain enamel activities at the World's Fair in Chicago is presented. F.G.H.

BOOKS

Metallography of Iron and Steel. C. HUBERT PLANT. Isaac Pitman & Sons, London and New York. 211 pp. Price $3.75. *Mining & Met.*, **14** [323], 469 (1933).—The purpose of this volume is to present a general survey of the theoretical metallurgy in its latest aspects so that the student, the executive, and the practical man may readily understand. E.J.V.

Foundry Course. Vol. I. General Rudiments (Cours de Fonderie, Tome I.—Notions Generales). M. F. RENAUD. Published by Librairie de l'Enseignement Technique, Paris, 1933. 568 pp. Reviewed in *Foundry*, **61** [6], 90 (1933).—A chapter on foundry refractories and the measurement of temperatures is included in this volume. F.G.H.

PATENTS

Lavatory. E. G. WATROUS. U. S. 1,930,633, Oct. 17, 1933.

Enamel formula. C. J. KASPAR. U. S. 1,933,437, Oct. 31, 1933. An enamel consists approximately of flint 29.236%, borax 13.127%, nitrate soda 5.727%, soda ash 10.740%, red lead 14.920%, barium carbonate 7.757%, fluorspar 6.563%, antimony oxide 4.773%, and sodium antimonate 7.160%.

Enameled sheet metal cooking receptacle. C. T. CARLSON (Republic Stamping and Enameling Co.). U. S. 1,933,890, Nov. 7, 1933.

Enameling fixture. HENRY TRENKAMP, JR. (Ohio Foundry Co.). U. S. 1,933,944, Nov. 7, 1933.

Enameling support and process of use. HENRY TRENKAMP, JR. (Ohio Foundry Co.). U. S. 1,935,420, Nov. 14, 1933.

Glass

Electrical behavior of glass at room temperature. E. M. GUYER. *Jour. Amer. Ceram. Soc.*, **16** [12], 607–18 (1933).

Viscosity-time-temperature relations in glass at annealing temperatures. H. R. LILLIE. *Jour. Amer. Ceram. Soc.*, **16** [12], 619–31 (1933).

Physical properties of the system SiO_2–Na_2O–K_2O–CaO. W. HÄNLEIN. *Z. tech. Physik*, **14** [10], 418–24 (1933).—The following properties of glasses in this system were determined: devitrification, electric conductivity, thermal expansion, density, and viscosity. Regularities found in two-component glasses were, with a few exceptions, confirmed in these measurements. W.M.C.

Is glass a rigid body? HUGO KÜHL. *Glashütte*, **63** [9], 155–57 (1933).—Seemingly rigid and brittle glass is more or less plastic and elastic. Elasticity and plasticity depend on the composition and working of the glass melt. Inhomogeneity of the glass is the reason for an increased brittleness and it depends on the preparation of the batch, melting, and working of the glass. The composition of the glass is of the greatest importance for the rigidity of its structure, for its elasticity, and hence for its plasticity. Alumina glasses are very viscous and elastic; glasses rich in lead are very viscous and plastic. Viscous and elastic glasses have a high impact strength and are resistant to pressure. Plasticity is a relative property of glass. Every glass is plastic in the softened state and is only distinguished by the height of temperature necessary to bring about the plastic state. The more elastic the glass is, the smaller is its plasticity. The crystallizing processes producing devitrification in old glasses are a proof that the arrangement of the molecules and their position change. These phenomena are not conditioned by newly originated formations of crystals but by the growth of those present. This transformation of glasses is considerably affected by their composition and working. Certain optical phenomena stipulated by chemical reactions confirm this rela-

tive movement of molecules in glass assumed to be rigid. Rays acting chemically release chemical processes in the glass. Another confirmation of the mobility of seemingly rigid molecules is yielded by the fluorescence of glasses containing copper when exposed to Röntgen rays and the violet coloring of manganese glasses originally colorless. M.V.K.

"Stingout" openings glass tanks. JOHN W. ROMIG. *Glass Ind.*, **14** [11], 115–16 (1933).—A theoretical discussion of the temperature drop in a tank due to openings in the upper structure or to radiation losses is presented. Examples of calculations of radiation losses are given. The effect of stingout or plus pressure loss and minus pressure loss is discussed. E.J.V.

Calculation of the working range of glasses. OSCAR KNAPP. *Keram. Rund.*, **40** [33], 425–27 (1933).—The calculation of the working range of glasses is shown by examples and illustrated by tables and diagrams. M.V.K.

Annealing of glass as a physical problem. L. H. ADAMS. *Jour. Franklin Inst.*, **216** [1], 39 (1933).—The formation of strain in cooling glass is explained and the laws for the release of stress and allowable cooling rate of glasses are discussed. The previous work of Adams and Williamson is reviewed and the annealing formulas restated in somewhat more general terms. Annealing time is redefined. It is shown that a Pyrex brand glass disk 200 in. in diameter and 30 in. thick can be annealed in 50 days, the cooling and soaking time intervals being approximately equal. The anomalies in physical properties observed during the annealing of glass are entirely distinct effects and in no way a part of the release of the elastic stress. Glass under purely internal elastic stresses does not have its density affected by these stresses. The bearing of viscosity and rigidity data on annealing problems and on the glassy state is brought out. Glass as a highly viscous solid is contrasted to glass as a true solid, *i.e.*, a body which will not flow under finite stress in infinite time. See following abstract. J.T.L.

Physical problem of annealing reviewed. ANON. *Amer. Glass Rev.*, **52** [43], 12 (1933).—The fundamental principles underlying the annealing of glass and the present state of knowledge concerning changes in the nature of glass during heating and cooling are reviewed. C.H.T.

Description of an electric cooling furnace. DOHNS. *Sprechsaal*, **66** [33], 561–62 (1933).—Details of a new electrically heated continuous cooling furnace employed for cooling white bottle glass and having a maximum production of 15 to 20 tons per 24 hr. are given. M.V.K.

Methods for testing tank blocks. A. MÖSER. *Tonind.-Ztg.*, **57** [74], 871–72 (1933).—The methods described include porosity and adsorption of the blocks and attack of the blocks by the glass melt. Both chemical and mechanical attacks may be studied by rotating a cylinder-shaped sample suspended in the melt. W.M.C.

Effect of dissolving ingredients of refractory materials on the composition of glass. ANON. *Glashütte*, **63** [14], 240 (1933).—The idea that the dissolving ingredients of refractories considerably influence the composition of glass melted in tank funaces is erroneous. When melting in pots, the dissolving ingredients of the pot affect the glass considerably more. Calculations illustrate the discussion. M.V.K.

Sulfate deposits in a glassmelting furnace. ANON. *Keram. Rund.*, **41** [12], 148 (1933).—Cases of sulfate deposition in different parts of a glassmelting tank and its effect on refractories are discussed. M.V.K.

Hot repairs of tank furnaces during operation. N. A. PENTKA AND A. S. RAZUMOV. *Keram. i Steklo*, **9** [6], 8–10 (1933).—Hot repairs during operation of a tank furnace at Zudov's glassworks are described. The repairs continued eight days. The only negative feature was the rapid corrosion of blocks during the first days after repairs due to the action of the cullet and melt on the refractories before the formation of the glassy layer on the surface of the blocks. M.V.K.

Employing heat insulation in the glass industry. KN. *Glashütte*, **63** [20], 337–40 (1933).—After discussing the losses of heat through radiation, conduction, and convection, ways for preventing it are discussed and the properties of good insulating brick are enumerated. The insulation of different parts of glassmelting furnaces is discussed. Data on the figure of thermal conductivity of materials employed in the glass industry are given. M.V.K.

Some general considerations of glassmaking molds. H. W. HOWES. *Jour. Soc. Glass Tech.*, **17**, 68–84*T* (1933).—The general scientific principles underlying the design, construction, and operation of glassforming molds are discussed, special attention being given to the subjects of mold temperatures and glass temperatures in their bearing on the wall thickness of the mold and on the arrangements made for cooling. Special requirements of paste molds, hot molds, and pressed glass molds are referred to. The chief requirements of the materials for the construction of hot molds are outlined. See also *Ceram. Abs.*, **12** [4], 148 (1933). C.H.T.

Fine sand for glass. I. I. KITAIGORODSKIĬ AND I. V. MYAKHLOV. *Keram. i Steklo*, **9** [6], 14–19 (1933).—The effect of the moisture of fine sand on the mixing of the batch and the effect of fine sand on the degasification of melts were studied. Conclusions are as follows: (1) The employment of fine sand in glassmelting is possible and expedient. (2) Dusting of the fine batch is less when using moist sand because moisture (3%) promotes the enveloping of the sand grains with alkaline particles producing a mechanical adherence of the mixed components. (3) Reactions proceed more rapidly with a fine sand than with coarse sand. (4) The beginning of the vitreous state in a batch containing fine sand is between 850 to 950° while a batch with coarser sand begins to vitrify at 1050 to 1150°. (5) The introduction of sodium sulfate makes it possible to obtain glass without bubbles. (6) The same amount of sulfate introduced into a batch with coarse sand retards the silicate reactions. M.V.K.

Tougher safety glass announced by American Window Glass Co. ANON. *Ceram. Ind.*, **21** [5], 212–13 (1933).—Plexite is a new kind of safety glass which uses a synthetic rubber as binder. Tests showed greater flexibility and less breakage. The binder is known as Plexigum. E.J.V.

Cellulose acetate plastic improves laminated safety glass. G. B. WATKINS AND J. D. RYAN. *Ind. Eng.*

Chem., **25** [11], 1192–95 (1933).—The history of the development of cellulose acetate plastic in its application to safety glass manufacture is briefly discussed. A comparison of the properties of cellulose acetate and cellulose nitrate plastics and results of comparative tests conducted on laminated safety glass made with each are outlined and illustrated. Data and photographs show protection afforded by cellulose nitrate and cellulose acetate laminated safety glass as compared with ordinary glass glazings. F.G.H.

Laminated safety glass. G. B. WATKINS AND W. D. HARKINS. *Ind. Eng. Chem.*, **25** [11], 1187–92 (1933).—Laminated safety glass has developed from an attempt to improve stained glass for church windows by making them in layers cemented together instead of separate pieces leaded into panes. Specifications for ideal safety glass are given. Various types of plastic materials and processes and equipment for bonding the glass are discussed. Numerous tests on the finished product are described, strengths of plate and laminated safety glass are compared, and the relation between the strength and thickness of the plastic is shown. F.G.H.

Use of cellulose plastic in laminated safety glass. R. A. MILLER. *Nat. Glass Budget*, **49** [19], 8 (1933).—The manufacture or assembly of laminated safety glass is described and problems of its fabrication are discussed. C.H.T.

History of safety glass. W. O. *Diamant*, **55** [26], 303 (1933).—The first attempts to manufacture splinterless or compound safety glass are described. M.V.K.

Neodymium glasses. ANON. *Ind. chimique*, **20** [233], 446 (1933).—It has been found that when admixing neodymium into the glass used for the manufacture of windshields for automobiles the part of the natural or artificial light producing the maximum of dazzling on the retina is absorbed. Contrary to other absorbing glasses, neodymium glass (called Neophan) does not disguise the color of objects but shows the illuminated objects with an exceptional distinctness. This glass may be employed in the manufacture of safety glasses of the "sandwich" type. M.V.K.

Why neodymium is a better physical decolorizer than nickel, cobalt, manganese, or selenium. JOHANNES LOEFFLER. *Sprechsaal*, **66** [37], 629–30 (1933).—Two extremes, physical and physiological colorlessness, can be obtained with the physical decoloration of normal silicate glasses. Physiological colorlessness can be combined with a very high clearness, especially in combination with chemical decoloration. The usual decolorizers, *e.g.*, manganese, cobalt, nickel, and selenium, absorb much of the light necessary for physiological colorlessness and therefore the glasses appear dark. Neodymium is almost an ideal decolorizer. Its absorption lies in a narrow range in yellow and a little in green. For practice, it is necessary to convert iron into the ferric form because neodymium covers the yellow color only and the action of neodymium should be supported by an absorption in the green, *e.g.*, to color somewhat into red. Only cerium preparations containing neodymium of the Auer Co. can be used. Some selenium should be added. A preparation free from cerium is recommended for refining with arsenic. All the usual decolorizers give the glass other color tones according to illumination. The most pleasant color tone is the one produced by neodymium and is called "evening tone." M.V.K.

"Noble-glass" objects. ANON. *Keram. Rund.*, **41** [9], 110–11 (1933).—The utilization of rare earths (neodymium, praseodymium, and cerium oxides) in the glass industry, their effect in glass melts, and the treatment of monasite sand are discussed. M.V.K.

Color tinge and transparency of glass plates. ANON. *Glashütte*, **63** [14], 238–40 (1933).—Methods for comparing and valuating variations of the color tinge and transparency of glass panes are discussed. M.V.K.

Bent glass signs. C. E. AVERY. *Glass Ind.*, **14** [9], 99 (1933).—Vitrifiable colors are applied to flat pieces of glass by the silk screen method. After all the colors have been applied the signs are placed on smooth cast-iron molds of the desired shape, previously coated with whiting to prevent sticking, and fired. Window glass or flashed opal glass are best fitted for concave or curved shapes. Illustrated. E.J.V.

Durable glass electrodes. D. A. MACINNES AND D. BELCHER. *Ind. Eng. Chem., Anal. Ed.*, **5** [3], 199–200 (1933). F.G.H.

Quantitative radiation measurements of industrial lamps extending over entire spectrum. H. KREFFT AND M. PIRANI. *Z. tech. Physik*, **14** [10], 393–411 (1933).—The intensity of the radiation was measured in different parts of the spectrum. Prismatic dispersion was combined with filters of a narrow range of transmission inserted into the path of light from the lamp under investigation. The measurements were carried out by means of a thermopile in the far infra-red and by means of a photoelectric cell in the ultra-violet, visible, and near infra-red regions of the spectrum. Results of measurements are presented for a black body, tungsten ribbon lamp, and gas discharge lamps. A thermocouple has been used in this work calibrated by means of a standard from the U.S. Bureau of Standards. All intensity values are based on the blackened thermocouple, thus avoiding the uncertainty regarding the emission characteristics of tungsten. W.M.C.

Directing rays through quartz opens up vast possibilities. WALDEMAR KAEMPFFERT. *New York Times*, Section 8 (Science), p. 6, Nov. 12, 1933.—K. discusses a paper read by A. Silverman at the meeting of the American Chemical Society held in Boston and dealing with glass and the possibilities of fused quartz. M.V.K.

Effect of glass containers on the electromotive force of Weston normal cells. G. W. VINAL AND M. LANGHORNE HOWARD. Bur. Stand., *Jour. Research*, **11** [8], 255–75 (1933). R.A.H.

Form of insulation for introduction of electrical connections into high-pressure vessels. H. J. WELDERGEN. *Jour. Sci. Instruments*, **10** [8], 247–48 (1933).—A seal for use at 3000 atmospheres at temperatures up to 200°C is described. It is formed by using Pyrex brand glass as the insulating material and embedding it in a plug of high chrome steel. Illustrated. J.L.G.

Study of the hydrogen-oxygen reaction. Adsorption of hydrogen on Pyrex brand glass and quartz. A. T. WILLIAMSON. *Jour. Amer. Chem. Soc.*, **55** [4], 1437–41 (1933).—The rate of adsorption of hydrogen on quartz

and Pyrex brand glass has been measured between 400 and 550°C at a pressure of 760 mm. Equilibrium values obtained on Pyrex brand glass are shown to correspond to true adsorption. It is shown that the attainment of equilibrium requires several hours' contact of gas and surface. F.G.H.

Glass and quartz filters for handling gases. P. H. PRAUSNITZ. *Ind. Eng. Chem., Anal. Ed.*, **4** [4], 430–34 (1932).—An exhaustive bibliography refers to many investigations using this technique. Applications discussed include mercury traps, explosion safety valves, dust filters, and gas-liquid reaction vessels. High-velocity gas flow in such apparatus is especially characteristic of glass filter apparatus and this is important in gas analysis where small quantities of an impurity in large volumes of gas are to be determined. Illustrations and diagrams are included. See also book, *Ceram. Abs.*, **12** [10–11], 404 (1933). F.G.H.

Technical development in the modern processes of manufacturing pane glass. MAURICE SCOHY. *Rev. belge ind. verrières, céram., émail.*, **4** [8], 170–75 (1933).—The manufacture of pane glass is composed of two essential operations, the working of the vitreous material and the obtaining of panes of glass from the vitreous material. Each operation necessitates the contribution of several factors, *viz.*, (1) melting of the raw materials and the formation of combinations whose total will produce glass; (2) study of the raw materials and of the batch; and (3) study of the thermal process which permits the bringing of the glass to the ideal state for working and consequently, the investigation of properties that the vitreous mass should possess. The changing properties of the glass during working and apparatus used are discussed. After describing the firing of tank furnaces, S. emphasizes the necessity of the chemical control of coal and the control of (1) thickness of ashes and coal, (2) air and steam pressure, (3) gas at the outlet, (4) gas temperature at the outlet, and (5) the chemical composition of the glass. Analysis of the burned gas, determination of excess air, temperature of the flame, temperature of the burned gas, and thermal balance are important factors. In order that the glass may have a constant chemical composition, it is necessary that the raw materials have a constant composition and that the mixture of these materials be established in such a way that the proportion of the glass constituents is constant. The completion of glass is based on viscosity, devitrification, and chemical resistance. Methods of measuring viscosity are described. The significance of the chemical resistance of glasses is discussed. To control the behavior of glass in the tank when introducing a new material it is necessary to (1) determine the addition of materials containing this new substance; (2) analyze the variations in the glass content in this element; (3) modify, if necessary, the temperature in different places of the tank to obtain perfect melting, refining, and a regular cooling; and (4) watch devitrification, *e.g.*, examine simultaneously the glass composition and the temperature at which crystals are formed. Coloration of the glass is another important factor. The color tone depends on the total amount of iron combined in FeO + Fe_2O_3 and the proportion of these two oxides. Decolorizers act chemically by oxidizing FeO and converting it into Fe_2O_3, less coloring, or forming with iron a colorless compound, and physically by bestowing a complementary tint to that of the iron. Most of the decolorizers used are oxidizers, *e.g.*, MnO_2 or As_2O_3 mixed with nitrate or alone. The latter has a purely chemical effect of oxidation and combination, while the former acts as oxidizer and complementary colorant. Selenium, cobalt oxide, nickel oxide, and cerium are physical decolorizers. The principles of the Fourcault, Pittsburgh, and Libbey-Owens processes are described in detail. The question of refractory products which is closely related to the study of glass is briefly discussed also. M.V.K.

Summary of a course of study of glass. R. D. *Rev. belge ind. verrières, céram., émail.*, **4** [7], 157–58 (1933).—The chemical constitution of glasses and their summary analyses are described. The microchemical analysis of Mylius and Groschuff (*Sprechsaal*, No. 15 (1910)) permits a rapid determination of the principal glass constituents. M.V.K.

Essentials of glass technology based on American practice. III. S. R. SCHOLES. *Ceram. Ind.*, **21** [5], 242–46 (1933).—S. continues the discussion of the various raw materials used in glass production. The properties of each material and the chemical method used in the preparation of some of the many materials are described. For Part II see *Ceram. Abs.*, **12** [12], 418 (1933). E.J.V.

Conception of art in the glass industry. J. WOLF. *Céram., Verrerie, Emaillerie*, No. 1, pp. 11–14 (1933).—Glass, as it was first known, was very costly and so was limited to decorative purposes only. With the advent of machinery and the consequent reduction in cost it took on a utilitarian value. At present the producer and artist work together to produce a beautiful but useful object at a reasonable cost. M.H.B.

Artistic and crystal glassware. WOLFGANG GREISER. *Glashütte*, **63** [13], 222–25 (1933).—The present trend in modern artistic and crystal glassware is discussed. Illustrated. M.V.K.

Glass houses a reality. E. M. SALER. *Göteborgs Ny Tid.*, Jan., 1933; *Glashütte*, **63** [13], 225–26 (1933).—Glass production methods for the use of glass as a building material are briefly described. M.V.K.

Building of tinted glass blocks. OWENS-ILLINOIS GLASS CO. *Christian Sci. Mon.*, **25** [221], 6 (1933); for abstract see *Ceram. Abs.*, **12** [10–11], 368 (1933). E.J.V.

Blowing glass containers for varied purposes. R. G. SKERRETT. *Glass Ind.*, **14** [10], 105–108 (1933).—Plant, methods, and products of the T. C. Wheaton Co., Millville, N. J., are described. Illustrated. E.J.V.

Germany and its glass industry. I–XVI. G. S. DUNCAN. *Glass Rev.*, **8** [8], 125–28; [9], 140–44 (1932); **9** [1], 11–16; [2], 23–25 (1933). A.A.

An Elizabethan glass furnace. T. PAPE. *Connoisseur*, **92** [385], 172–77 (1933).—An interesting description is given of an excavated glass furnace dating before 1666 found in Bishop's Wood in Staffordshire, England. Illustrations show the construction of the furnace and sample ware found. E.B.H.

Glass in the Philippines. WALTER BUCHLER. *Glass Ind.*, **14** [11], 122 (1933).—Glass was introduced in the

Philippines with the American occupation. French plate glass has been used for store windows and window glass for buildings. Common window glass imported from Belgium is used for houses and show cases. Figured glass is extensively used for church windows. E.J.V.

Professor Silverman's famous collection of glass. ANON. *Glass Ind.*, **14** [11], 118–21 (1933).—A description of the collection acquired during the past thirty-one years, comprised of specimens from all parts of the world, representing the art and technique of glass manufacture is given. Illustrated. E.J.V.

Glossary of household glass terms. E. M. BOYKIN. *Amer. Home*, **10** [1], 8–48 (1933).—Thirteen varieties of household glassware are described and illustrated in this practical article which correlates design and composition for the home maker. F.G.H.

Glass tile uses metal stripping in application. MACBETH-EVANS GLASS CO. *Ceram. Ind.*, **21** [3], 134 (1933).—Illustrated. E.J.V.

New era in glass tableware. LIBBEY GLASS MFG. CO. *Ceram. Ind.*, **21** [3], 120–23 (1933).—Illustrated. E.J.V.

Curtain window glass. ANON. *Chambers' Jour.*, 717–18 (Sept., 1933).—Window-glass is now obtainable in which lace and other fabrics are hermetically sealed between two thicknesses, thus giving the window the appearance of having a curtain behind it, and at the same time rendering the curtain dust-, fire-, and germ-proof. Table-tops, etc., can be similarly treated. H.H.S.

Glass silk for insulation and dress fabrics. CHANCE BROTHERS & CO., LTD. *Ceram. Ind.*, **21** [3], 123 (1933); for abstract see *Ceram. Abs.*, **12** [6], 219 (1933). E.J.V.

BOOKS

The Glassy State. GUSTAV TAMMANN. *Rev. belge ind. verrières, céram., émail.*, **4** [7], 162 (1933); *Glastech. Ber.*, **11** [7], 256–57 (1933); for abstract see *Ceram. Abs.*, **12** [12], 418 (1933). M.V.K.

The Physical Properties and the Melting of Glass. BERNARD LONG. *Glass Ind.*, **14** [9], 100 (1933); for review see *Ceram. Abs.*, **12** [7], 260 (1933). E.J.V.

PATENTS

Apparatus for cutting glass sheets. C. F. BURDETT AND WILLIAM OWEN (Pittsburgh Plate Glass Co.). U. S. 1,930,582, Oct. 17, 1933.

Process of acid grooving safety glass. B. J. DENNISON (Duplate Corp.). U. S. 1,930,587, Oct. 17, 1933.

Fire finisher. I. H. FREESE (Hazel-Atlas Glass Co.). U. S. 1,930,746, Oct. 17, 1933.

Roller for drawing flat sheet glass. JOSEPH GASKELL (Pilkington Bros., Ltd.). U. S. 1,930,999, Oct. 17. 1933.

Glassware forming machine. W. L. VAN NESS (Owens-Illinois Glass Co.). U. S. 1,931,336, Oct. 17, 1933.

Machine for forming hollow glassware. C. C. COOK AND CHARLES BADGER (Owens-Illinois Glass Co.). U. S. 1,931,375, Oct. 17, 1933.

Glassblowing machine. AUGUST KADOW AND J. E. MCLAUGHLIN (Owens-Illinois Glass Co.). U. S. 1,931,497, Oct. 24, 1933.

Apparatus for conveying glass sheets. L. VON REIS (American Bicheroux Co.). U. S. 1,931,628, Oct. 24, 1933.

Handling glass sheets. J. F. MURPHY AND PETER MAGRINI (American Window Glass Co.). U. S. 1,931,700, Oct. 24, 1933.

Timing device for glass machinery. S. G. STUCKEY (Obear-Nester Glass Co.). U. S. 1,932,024, Oct. 24, 1933.

Process and apparatus for breaking off lengths of wired glass. HARRY SMITH (Pilkington Bros., Ltd.). U. S. 1,932,149, Oct. 24, 1933.

Leer loader. S. B. BOWMAN, EDWIN HAUB, AND H. D. JACKSON (Hazel-Atlas Glass Co.). U. S. 1,932,301, Oct. 24, 1933.

Process and apparatus for use in molding articles of fused quartz. A. O. F. v. B. MARCONNAY (Thermal Syndicate, Ltd.). U. S. 1,932,402, Oct. 31, 1933.

Process and apparatus for the production of sheet glass. WILLIAM WILDERMUTH (Libbey-Owens-Ford Glass Co.). U. S. 1,932,651, Oct. 31, 1933. L. C. MAMBOURG (Libbey-Owens-Ford Glass Co.). U. S. 1,932,669, Oct. 31, 1933. J. M. FISHER (Pittsburgh Plate Glass Co.). U. S. 1,934,-794, Nov. 14, 1933.

Transfer mechanism for glassware. A. W. BEESON (Hazel-Atlas Glass Co.). U. S. 1,932,683, Oct. 31, 1933.

Apparatus for making glass tubing. H. K. RICHARDSON (Westinghouse Lamp Co.). U. S. 1,933,341, Oct. 31, 1933.

Electrically heated tank for glass. H. A. WADMAN (Hartford-Empire Co.). U. S. 1,933,527, Oct. 31, 1933.

Method of surface treating glassware. THOMAS WARDLEY AND J. B. MURGATROYD (Hartford-Empire Co.). U. S. 1,933,529, Oct. 31, 1933.

Furnace and method of furnace operation. WILLIBALD TRINKS (Libbey-Owens-Ford Glass Co.). U. S. 1,933,571, Nov. 7, 1933.

Apparatus for use in manufacturing laminated glass. C. B. SCHAFER (Libbey-Owens-Ford Glass Co.). U. S. 1,933,639, Nov. 7, 1933.

Glass-edging machine. C. B. SCHAFER (Libbey-Owens-Ford Glass Co.). U. S. 1,933,640, Nov. 7, 1933.

Process of producing glass. H. M. KRANER. U. S. 1,933,739, Nov. 7, 1933. The process of producing glass includes the step of combining a partially vitrified material produced by firing a body including clay and a flux with other glassforming ingredients.

Glasshouse roof construction. H. W. PRATT (W. H. Lutton Co.). U. S. 1,934,002, Nov. 7, 1933.

Manufacture of wire glass. G. H. JUERGENS (Mississippi Glass Co.). U. S. 1,934,354, Nov. 7, 1933.

Apparatus for feeding molten glass. J. W. HARDING (Brockway Machine Bottle Co.). U. S. 1,934,676, Nov. 7, 1933. W. R. STERRETT (Ball Brothers Co.). U. S. 1,935,527, Nov. 14, 1933.

Process of manufacturing reinforced glass sheets. ROBERT DELLOYE. U. S. 1,934,682, Nov. 14, 1933.

Method and apparatus for making composite glass. J. H. SHERTS (Duplate Corp.). U. S. 1,934,772, Nov. 14, 1933.

Plate glass polisher. H. J. GALEY (Pittsburgh Plate Glass Co.). U. S. 1,934,797, Nov. 14, 1933.

Process and apparatus for making insulating glass.

FREDERICK GELSTHARP (Pittsburgh Plate Glass Co.). U. S. 1,934,798, Nov. 14, 1933.

Method and means for feeding glass. W. J. MILLER. U. S. 1,934,811, Nov. 14, 1933.

Apparatus and method for manufacturing glass stems. P. V. MALLOY (Raytheon Production Corp.). U. S. 1,935,248, Nov. 14, 1933.

Lamp chimney forming machine. E. S. BRUNSON. U. S. 1,935,541, Nov. 14, 1933.

Reinforced vitreous panel and method of making. W. N. THURN (Vitrolite Co.). U. S. 1,935,583, Nov. 14, 1933.

Vitreous panel having anchoring means and method of making. W. N. THURN (Vitrolite Co.). U. S. 1,935,584, Nov. 14, 1933.

Manufacture of laminated nonsplintering glass. IMPERIAL CHEMICAL INDUSTRIES, LTD., AND A. RENFREW. Brit. 398,855, Oct. 4, 1933.

Method and apparatus for working glass. P. H. D. DE FONBRUNE. Brit. 400,109, Oct. 25, 1933.

Apparatus for handling glass sheets in sheet-drawing apparatus. C. J. FEENY (Naamlooze Vennootschap Hollandsche Maatschappij voor de Vervaardiging van Glas). Brit. 400,110, Oct. 25, 1933.

Observation or gage glasses, tubes, etc. C. H. GLOVER. Brit. 400,309, Nov. 1, 1933.

Machines for producing glass vessels from tubing. J. DICHTER. Brit. 400,426, Nov. 1, 1933.

Apparatus for the manufacture of vitreous products by drawing or rolling. SOC. ANON. DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY ET CIREY. Brit. 400,472, Nov. 1, 1933.

Structural Clay Products

Hints on making highly porous blocks. ANON. *Brit. Clayworker*, **42** [497], 169 (1933).—The chief properties which highly porous blocks are required to possess are (1) low weight per cubic foot, (2) high porosity, (3) uniform distribution of pores, (4) ready reception and retention of nails, (5) heat-insulating power, and (6) sound insulating power. These properties are secured by the use of naturally porous granules such as diatomaceous earth or the use of a mixture of pore-producing material and clay. The clay used should have great binding power (not necessarily the same as plasticity) and a long vitrification range. Sawdust is very superior to coal dust in increasing the heat-insulating power of the blocks. R.A.H.

Manufacturing light-weight brick with an addition of sawdust. E. HILDEBRANDT. *Tonind.-Ztg.*, **57** [66], 768 (1933); for abstract see *Ceram. Abs.*, **12** [5], 190 (1933). W.M.C.

Swedish and Danish brickwork. P. E. D. HIRST. *Brit. Clayworker*, **42** [496], 144–50 (1933).—In Sweden almost all the buildings of any consequence are built entirely of brick or brick enters largely into their structure. Stone buildings are conspicuous because they are relatively few. Concrete though increasingly used is usually reserved for buildings in which utility is the predominating factor. Denmark, like Sweden, has a very limited supply of stone and it is not a great timber growing country. It possesses suitable brick clay and consequently the Danes have made this their chief building material. Modern utility buldings, such as factories, make use of reinforced concrete in their construction. H. discusses in detail the various types of brickwork used in many of the buildings of these two countries. R.A.H.

Use of face brick in small houses. K. W. SCHULZE. *Tonind.-Ztg.*, **57** [69], 805–807 (1933).—Face brick are being used again extensively in small houses. Illustrated. W.M.C.

Hard-fired brick for federal automobile highways. BYCZKOWSKI. *Tonind.-Ztg.*, **57** [69], 807–808 (1933); see also *Ceram. Abs.*, **12** [10–11], 373 (1933). W.M.C.

Hard-fired brick for highway construction. C. HEUER. *Tonind.-Ztg.*, **57** [72], 844–45; [74], 869–71; [76], 895–97 (1933).—Analyses are presented of characteristic clays used in manufacturing hard-fired brick. Equipment used in dry pressing the brick is described as well as the stiff-mud process. Different types of extruding machines, kilns, etc., are presented. Illustrated. W.M.C.

Use of hard-fired brick for hydraulic structures. ANON. *Tonind.-Ztg.*, **57** [69], 810–11 (1933).—This material should withstand both mechanical and chemical actions. Careful manufacturing is emphasized. W.M.C.

Vitrified brick as a paving material. E. HILDEBRANDT. *Tonind.-Ztg.*, **57** [84], 990–91 (1933).—Methods of road construction are outlined in which vitrified brick might be used. Illustrated. W.M.C.

Self-bonding brick and die for making them. DAVIS BROWN. *Brick Clay Rec.*, **83** [3], 79 (1933).—Brick and blocks with holes of sufficient size to permit mortar to enter and act as dowels to bond the brick together are proposed. Dies for producing them are also described. Illustrated. E.J.V.

Strength of flat-arch clay tile floor construction. GEORGE E. LARGE AND CLYDE T. MORRIS. *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 78; *Brick Clay Rec.*, **83** [3], 88-89 (1933).—A report of experiments made on the effect of varying construction conditions placed on structural clay tile floors is presented. E.J.V.

Faults in drying hollow tile. E. SCHONDORFF. *Tonind.-Ztg.*, **57** [76], 893–94 (1933).—Drying methods used for tile in open sheds or in artificial drying plants are reviewed. W.M.C.

Hollow sand-lime tile. BEHNISCH. *Tonind.-Ztg.*, **57** [73], 860–61 (1933).—The manufacture of hollow sand-lime tile is described. Plans are presented showing the action of the heavy press used. See also article by Triffterer, *Ceram. Abs.*, **12** [10–11], 372 (1933). W.M.C.

New type of slab brick. EDWARD A. HAUPT. *Brick Clay Rec.*, **83** [4], 121 (1933).—The patented "Haupt Slabrick" unit is a multiple brick with a $3^3/_4$-inch bed and is made in one piece containing any number of brick in any number of desirable courses so arranged that one brick projects into the end of the next slab. This arrangement provides the feature of being able to turn a right angle corner or to lay a continuous running bond. The

face of the slab may be either scored, ready to receive pointing, or manufactured with the mortar material already in place, excepting at those points where the Slabrick units are laid up. Speedier and more accurate laying of walls with less mortar necessary are advantages claimed for the product. Illustrated. E.J.V.

Ceramic developments at Chicago meeting of A.S.T.M. ANON. *Ceram. Age*, **22** [2], 51 (1933).—Three papers of ceramic importance were (1) tests on brick masonry beams, by M. O. Withey, (2) a hypothesis on the permeability of brick masonry walls, by W. C. Voss, and (3) a survey of common brick properties, by J. W. McBurney and C. E. Lovewell. F.G.H.

Statistics for the German brick industry. ANON. *Tonind.-Ztg.*, **57** [81], 951–52 (1933). W.M.C.

Limits of rentability of brick plants when cutting down the output. F. SCHOBER. *Tonind.-Ztg.*, **57** [82], 965–66 (1933).—The minimum output is calculated for the following three types of plants: If the normal yearly output amounts to more than 5 millions of common brick no rentability will be found for an output of less than 4 million brick. Plants with an output of 1 to 5 millions of common brick may decrease their output by 34%. Plants of an output of less than 1 million brick will lose their rentability when the production is decreased by 55%. W.M.C.

What Australia thinks of concrete sewer pipe. ANON. *Brick Clay Rec.*, **83** [4], 128–29 (1933).—The Report of the Royal Commission of Investigation into Certain Matters Under the Administrative Control of the Metropolitan Board of Water. Sewerage, and Drainage (Sydney, Australia) shows that the use of concrete pipe must be limited and subjected to definite restrictions. E.J.V.

Brick industry in England. ANON. *Brick Clay Rec.*, **83** [4], 130–31 (1933).—An interesting report of the situation in England with data on production, wage rates, productivity, and other points worthy of study is given. E.J.V.

Persian brick plants. ANON. *Tonind.-Ztg.*, **57** [79], 931–32 (1933).—Most common brick are handmade. Only one plant using modern machinery is being operated at present. The shape of the brick must be very accurate because the Persian mason uses them for ornamental work in the same way as he has for several thousand years. Illustrated. W.M.C.

BULLETINS

Sand-Lime Brick. ANON. *Concrete Constr. Eng.*, **28** [3], 203 (1933).—The British Standards Institution announces a revision of its publication No. 187, Sand-Lime (Calcium Silicate) Brick, which was originally issued in 1923. The main specifications dealt with are size, adsorption, classification, tests for strength, and composition. The new features introduced are revised crushing strengths, values for modulus of rupture which may be used if desired instead of the crushing strength, and composition. Suitable chemical tests are provided. F.G.H.

Damp masonry walls above grade. ANON. Bur. Stand., *Letter Circ.*, No. 391, 13 pp. Free. Causes of dampness on the interior surfaces of masonry walls above grade are enumerated. The conditions favorable to condensation on such walls are described. Inadequate protection of masonry from water collected on roofs or other horizontal or sloping surfaces is cited as a frequent cause of dampness. Relations between rainfall, wind velocities, and absorptive properties of masonry walls are found to indicate that occasional dampness should be expected when plaster is applied to interior surfaces of ordinary walls 8 inches in thickness. Different types of colorless waterproofings are compared and methods for treating masonry are discussed. Specific methods are given for remedying dampness in masonry walls. R.A.H.

PATENTS

Partition tile construction. P. K. DOTSON. U. S. 1,930,951, Oct. 17, 1933.

Method and apparatus for forming building blocks. H. F. GEIST. U. S. 1,930,970, Oct. 17, 1933.

Method of making lightweight blocks. ERIK HÜTTEMANN AND WOLFGANG CZERNIN (F. O. Anderegg). U. S. 1,932,971, Oct. 31, 1933.

Building structure. E. T. ANDERSON (American Reinforced Paper Co.). U. S. 1,934,651, Nov. 7, 1933.

Refractories

Refractories. II. ALFRED H. LOVELESS. *Blast Fur. Steel Plant*, **21** [10], 552 (1933).—Desirable properties in refractories include resistance to load at working temperatures, resistance to stresses caused by changes in temperature, hardness sufficient to resist cutting action by flame and dust, resistance to chemical attack, and density. It is impossible for a refractory to have all of these properties highly developed and sacrifices must be made in favor of those of particular importance for the particular purpose in view. For Part I see *Ceram. Abs.*, **12** [12], 422 (1933). E.J.V.

Refractory materials and their employment in industrial furnaces. L. RAMZINE. *Chaleur & ind.*, **14** [158], 251–65 (1933).—After describing conditions to which refractories are subjected in modern furnaces, R. discusses their main properties. A table with data on nine types of refractories is given. Methods used in Russia to determine the resistance to heat of refractories are described. The following points of interest are also discussed: (1) methods for determining the suitability of refractories when using different kinds of fuel, (2) loss of heat through the masonry, temperature of the walls, refractory coatings, and construction of the vertical surface of the coating, (3) erection of crowns, (4) cooling the walls of the lining, (5) refractory cements, (6) data furnished by practice on the wearing of the hearths of boiler houses, (7) various conditions under which brick of the same hearth work, and (8) general conclusions. M.V.K.

Industrial use of highly refractory materials. ANON. *Ind. chimique*, **20** [234], 546 (1933).—Highly refractory materials belong to the three following groups: (1) carbides (titanium, zirconium, hafnium, niobium, tanta-

lum, molybdenum, and tungsten) whose fusing points are from 3130 to 4160°, (2) nitrides (zirconium, titanium, and tantalum) with fusing points from 3220 to 3360°, and (3) borates of tungsten and zirconium melting at 3265 and 3195°, respectively. These materials are obtained by heating the metal or oxide in the presence of carbon for carbides, in a current of nitrogen for obtaining nitrides, and in the presence of boron to obtain borates. These materials have a metallic luster, a hardness from 8 to 10 (scale of Mohs), and a great electrical conductivity which generally increases with the temperature. These products are generally unaffected by chemical agents and air at high temperatures. M.V.K.

Use of refractories in industrial furnaces. Use of cements, coatings, and plastics in furnace construction. VIII. F. H. NORTON. *Fuels & Fur.*, **11** [4], 125–34 (1933).—The analyses, characteristics, uses, and methods of applying high-temperature refractory cements, low vitrifying cements, and air setting cements, high silica, high alumina, natural fire clay, silicon carbide base, raw chromite base, mullite grog, cyanite, andalusite, or sillimanite grog base, corundum, zircon and zirconia coatings, and plastic refractories are discussed. For Part VII see *Ceram. Abs.*, **12** [10–11], 378 (1933). E.J.V.

Investigations of quartzites of the Poltavskii beds of the Ocheretino region. P. P. BUDNIKOFF. *Mineral. Suir'e*, **8** [5], 11–20 (1933).—Data on the quartzite deposits and experiments in using them are given. The quartzites should be fired from 1200 to 1480° for 35 hr. to obtain good refractories. M.V.K.

Refractory and fine ceramic material. ANON. *Keram. Rund.*, **41** [15], 192 (1933); abstracted in *Feuerfest*, **9** [6], 92 (1933).—A nonplastic clay rock has been mined at the Agalmatolithe and Quartzite works in Czechoslovakia. It can be used in refractories for the glass, cement, and foundry industries and for saggers and muffles. Special tests on this clay rock for manufacturing tank blocks and glasspots show satisfactory resistance to melted soda and easily fusible window glass melts. M.V.K.

X-ray investigation on bauxites and mullites. M. E. NAHMIAS. *Trans. Ceram. Soc.* [Eng.], **32** [7], 332–36 (1933); for abstract see *Ceram. Abs.*, **12** [10–11], 374 and 376 (1933). R.H.H.P., JR.

Furnace glaze for refractory walls. MILDON ENGINEERING CO. *Power*, **77** [7], 387 (1933).—It is claimed that "Fire-Kote" contains no sodium silicate, fuses progressively beween 1200 and 2800°F, and does not re-fuse or run at much higher temperatures. It does not flake off, is not affected by sudden changes of temperature, and becomes an integral part of the surface to which it is applied. F.G.H.

Employing and testing refractory stamping and coating mixes. ANON. *Feuerungstechnik*, **21** [8], 114–15 (1933).—Methods employed for testing properties are described in detail. M.V.K.

Refractory mixes as coating, repairing, and jointing material. ANON. *Feuerungstechnik*, **21** [9], 128–29 (1933).—The properties of different refractory cements and mixes on the market for coating, repairing, and for filling joints between brick are discussed. Ways of using them are described. M.V.K.

Refractory mortars used for repairing silica coke ovens. E. COMBLÉS. *Stahl & Eisen*, **53** [38], 984–88 (1933).—Experiments were carried out with different types of silica mortars. The following data are presented: chemical composition, grain size, melting point, softening under load, thermal expansion, and breaking strength. The influence was studied of additions to the mortars, such as water glass, fine iron ore, and soda. Costs are compared for repairing furnaces by means of smearing and spraying. Special cast iron plates may be used at places where no mortar can be used. W.M.C.

Thermal expansion of refractories to 1800°C. R. A. HEINDL. *Brick Clay Rec.*, **83** [2], 59–62 (1933); for abstract see *Ceram. Abs.*, **12** [9], 330–31 (1933). E.J.V.

Investigations of graphite deposits from the Naginskii deposits. V. S. VESELOVSKIĬ AND V. K. CHAIKOVSKIĬ. *Mineral. Suir'e*, **8** [2], 36–38 (1933). M.V.K.

Sretenskii graphite deposits. I. I. ORESHKIN. *Mineral. Suir'e*, **8** [2], 5–22 (1933). M.V.K.

High-temperature furnace using graphite crucible. D. A. MOULTON. *Brick Clay Rec.*, **83** [4], 132 (1933).—A description of a carbon-resistance furnace built of a nonconducting refractory and using a graphite crucible is given. The manufacture of crucibles from rods of graphite is cited. Illustrated. E.J.V.

Manufacture of slag-resistant crucibles for the coreless induction furnace. H. SIEGEL. *Arch. Eisenhüttenwesen*, **7**, 21–23 (1933).—Crucibles were made of refractory materials of varying grain sizes. Best results were obtained with crucibles containing a mixture of several grain sizes and a good bond. A ring of slag-resistant Siemensite may be used in the zone of maximum attack of the crucibles by the slag. W.M.C.

Attack of refractory brick by alkali chloride vapors. LUDWIG STUCKERT. *Sprechsaal*, **66** [34], 573–74; [35], 591–94 (1933).—The testing of the resistance of refractory brick to dry and moist alkali chloride vapors and the results obtained with different kinds of brick are described. The valuation of the behavior of separate kinds of brick was based on microscopical testing, vitrification, changes of volume, and microscopical comparisons of the original samples with those attacked. M.V.K.

Improving kiln furniture with talc. G. C. BETZ. *Ceram. Age*, **21** [4], 104–25 (1933). F.G.H.

Lengthening sagger life with talc. D. HAGAR. *Ceram. Age*, **21** [2], 35–63 (1933). F.G.H.

Slag-tap furnaces. C. G. COLES. *Power*, **77** [4], 212 (1933).—Characteristics of the slag-tap furnace are discussed. F.G.H.

Open-hearth furnace problems. ANON. *Jour. Inst. Fuel* [London], **6** [30], 349–87 (1933); *Iron Coal Trades Rev.*, **126** [3405], 866 (1933).—The following papers are presented and discussed: (1) Gas-air control in open-hearth furnaces, by V. H. Legg, (2) Economic regenerators for open-hearth furnaces, by Helmut Trinius (*Ceram. Abs.*, **12** [9], 332 (1933)), and (3) Calculation of open-hearth regenerators, by Herbert Southern. W.E.R.

Lighting up vertical retorts after repairs. H. SMITH. *Gas World*, **98** [2530], 69–73 (1933); abstracted in *Feuerfest*, **9** [3], 46 (1933).—The paper deals with (1) maintenance of steady conditions, (2) extra pressure leakage, (3) lighting up after repairs, (4) tile and main dampers, (5)

method of increasing temperature, (6) infiltration of cold air, (7) secondary air slides, and (8) stack pull and producer gas. M.V.K.

Regenerators used in German blast-furnace plants. H. SCHMITZ. *Stahl & Eisen*, **53** [32], 821–31; [33], 856–61 (1933).—This is a review of the construction and operation of regenerators in many plants. The most satisfactory type of construction is discussed based on present knowledge of heat transfer by means of convection. Narrow conduits and high rate of flow are desirable though limited by the danger of clogging the conduits and increasing resistance by the masonry. The masonry should show good refactoriness, high specific heat, and good heat conductivity. The width of the brick should decrease from the upper to the lower part of the regenerator to obtain the same temperature changes both in the core of the brick and in its outer part. Circular shaped conduits are the most satisfactory ones. A rough or wavy surface of the masonry is recommended. The installation of three regenerators for one blast furnace is emphasized. W.M.C.

Drafting blast-furnace recuperators. K. RUMMEL. *Arch. Eisenhüttenwesen*, **7**, 175–78 (1933).—Dimensions are calculated for a given amount of air to be heated, for average hot air temperature, and for a minimum temperature of heated air. The surface roughness of the tile is of major influence on the construction of the recuperators, as well as rate of flow, diameter of conduits, heat transfer, and friction losses. W.M.C.

"Tercod," new refractory brick. ANON. *Metal Ind.* [London], **43** [2], 32 (1933); for abstract see article by Diamond, *Ceram. Abs.*, **12** [9], 332 (1933). M.V.K.

Work of the Leningrad Scientifico-Technical Department of the I. P. M. ANON. *Mineral. Suir'e*, **8** [2], 66–77 (1933).—A report of papers discussed includes (1) abrasives, (2) manufacture of electrocorundum, (3) corundite brick, (4) graphite tubes for electrofilters, and (5) different raw materials. M.V.K.

Safety welfare in refractory manufacture. D. R. WILSON. *Foundry Trade Jour.*, **49**, 122 (1933).—The code drawn up between H. M. Chief Inspector of Factories and the National Council of Associated Ironmasters is summarized. H.H.S.

BOOKS AND BULLETINS

High-Melting Refractories and Their Technical Application. (Hochschmelzende Hartstoffe und ihre technische Anwendung.) K. BECKER. Verlag Chemie, G.m.b.H., Berlin, 1933. 227 pp. Reviewed in *Jour. Inst. Metals*, **53** [7], 426 (1933). F.G.H.

Heat-Exchange Apparatus. (Die Wärmeaustauschapparate.) E. KIRSCHBAUM. Walter de Gruyter and Co., Berlin and Leipzig, 1933. 104 pp. Price 1.62 Rm. *Mech. Eng.*, **55** [9], 592 (1933).—The principles underlying the design of heat exchangers, together with the basic equations, are presented and their use is illustrated. F.G.H.

Furnace Roofs. (Feuerungsdecken.) KARL HARRAEUS. Carl Heymans, Berlin, Germany. 106 pp. Paper 10 M; bound, 12 M. *Blast Fur. Steel Plant*, **21** [8], 440 (1933); *Power*, **77** [8], 438 (1933).—A history of furnace roofs on the basis of patent records and other publications is given. Six pages are devoted to arched roofs, the rest dealing with suspended roofs, single, double, cooled, insulated, adjustable, and monolithic. E.J.V.

Outline of the manufacture and properties of handmade brick. S. M. PHELPS. *Amer. Refrac. Inst. Tech. Bull.*, No. 41, 7 pp. (1933).—An elementary explanation is given of the processes of manufacture of handmade brick, which, although largely superseded by machine methods for the manufacture of standard brick and shapes, will undoubtedly be continued for certain types of brick and intricate shapes. A flow sheet is given accompanied by a step-by-step explanation in which are indicated the preferred practices where two or more are optional. A table gives the principal characteristics of 18 brands of handmade brick, *i.e.*, average refractoriness, moderate to poor resistance to subsidence in the standard load test, good resistance to thermal spalling, rather high porosity, and moderate strength. Illustrated with 6 figs. W.E.R.

Specifications for refractories to be used for federal construction. L. C. HEWITT. *Amer. Refrac. Inst. Tech. Bull.*, No. 40, 6 pp. (1933).—The three existing federal specifications for refractory materials are fireclay brick, fire clay, and plastic fireclay refractories. The departmental specifications that conform to these are tabulated. Misunderstandings that may arise from the use of obsolete specifications are pointed out and suggestions made for avoiding them. The revised specifications for fireclay brick (mandatory after April 15, 1933) include a spalling test which, although it increases the number of brands acceptable, is undesirable from the standpoint of the industry because it is unfair to certain brick high in silica and known to be satisfactory in service, the preheating period is thought to be too long, and it does not conform to the A.S.T.M. standard whereby it requires duplication of testing. W.E.R.

Ceramic Insulating Materials. AMERICAN LAVA CORP. Reviewed in *Power*, **77** [7], 391 (1933).—This bulletin describes insulating materials of high dielectric strength and extreme heat-resisting qualities which are acid-resisting and noncorrosive and possess good mechanical strength. F.G.H.

Temperature gradients. J. G. STEIN & Co. *Refrac. Bull.*, No. 16, April, 1933; abstracted in *Feuerfest*, **9** [6], 93 (1933).—Conductivity curves for [illegible], silica, and insulating brick are discussed. Temperatures of the interior and outside surface of walls of different thickness made of grog and silica brick are di[illegible] M.V.K.

PATENTS

Process for manufacture of alumina. HEINRICH SPECKETER AND KONRAD ROSENBERGER (I. G. Farbenind. Akt.-Ges.). U. S. 1,931,515, Oct. 24, 1933.

Insulating cement. A. V. LEUN AND L. H. ROFFE (Bethlehem Steel Co.). U. S. 1,933,271, Oct. 31, 1933. An insulating cement is composed of slag wool, asbestos fiber, bentonite, a modifying clay, and sodium carbonate.

Apparatus for applying cementitious material. J. E. ANDERSON (Plibrico Jointless Firebrick Co.). U. S. 1,933,543, Nov. 7, 1933.

Refractory. KARL HACKS AND W. S. SPROW. U. S.

1,934,263, Nov. 7, 1933. The method of fusing a refractory lining upon an interior surface of a furnace comprises applying to the surface a layer formed of a mixture of granular refractory and particles of a readily oxidizable metal and oxidizing the metal of such mixture to supply heat for fusing the refractory.

Sintered magnesia and refractory materials containing sintered magnesia. ALTERRA AKT.-GES. Brit. 399,126, Oct. 4, 1933.

Manufacture of articles of refractory material such as silica. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 399,749 and 399,750, Oct. 18, 1933.

Terra Cotta

Water-tight terra cotta masonry. F. O. ANDEREGG. *Jour. Amer. Ceram. Soc.*, **16** [12], 634–38 (1933).

Terra cotta cracking. F. B. ORTMAN. *Jour. Amer. Ceram. Soc.*, **16** [12], 639–42 (1933).

Distinguishing tile according to their composition, some properties of their bodies, and methods for their manufacture. O. KALLAUNER. *Sprechsaal*, **66** [30], 507–508 (1933).—The chief characteristics of different kinds of tile and a short description of methods used for their manufacture are given. The following tile are described: (1) stoneware, (2) grog, (3) faience, and (4) ordinary tile. Compositions of glazes used are given also. M.V.K.

Chemical stoneware development. ANON. *Metal Cleaning & Finishing*, **5** [10], 434–35 (1933).—By a combination of electrolytic, chemical, and mechanical developments, the United States Stoneware Co., Akron, Ohio, is producing "Lectrovac" chemical stoneware possessing great strength, density, and resistance to thermal and mechanical shocks. Equipment made from this new material may now be supplied in lighter walls and thinner sections than formerly offered. E.J.V.

Stoneware achieves new dignity. A. HAMMER. *Ceram. Age*, **21** [4], 106–107 (1933). F.G.H.

PATENTS

Apparatus for making roof tile. OTTO WALTER. U. S. 18,999, Nov. 14, 1933 (reissue).

Attachment for machines for making clay shingles. J. B. NELSON AND A. J. MOORE. U. S. 1,931,617, Oct. 24, 1933.

Shiplap brick siding. FREDERICK SCHAFFERT. U. S. 1,931,709, Oct. 24, 1933.

Tiled wall, etc. R. C. WORDEN. U. S. 1,932,433, Oct. 31, 1933.

Monolithic wall structure. N. L. ABERSON. U. S. 1,933,237, Oct. 31, 1933.

Roofing. H. G. GOSLIN (Sherriff-Goslin Co.). U. S. 1,934,666, Nov. 7, 1933.

Sheet metal faced structural and insulating unit. G. A. BOLE AND J. D. SULLIVAN (Battelle Memorial Inst.). U. S. 1,934,788, Nov. 14, 1933.

Dies for use in the manufacture of tile for walls, fireplaces, etc. E. F. MILLWARD AND WOODS TILERIES (Hanley), LTD. Brit. 400,107, Oct. 25, 1933.

Manufacture of tile or slabs from ceramic earthenware, etc. RAINFORD POTTERIES, LTD., AND F. W. GRUNDY. Brit. 400,535, Nov. 1, 1933.

White Wares

Talc to stop crazing. D. HAGAR. *Ceram. Age*, **21** [3], 74–75 (1933). F.G.H.

Dense ceramic special materials. ANON. *Sprechsaal*, **66** [30], 519 (1933).—Data on new ceramic materials, "Frequentite" and "Sipa," having a steatite base and which are valuable for electrothermal and heating technique, are given. M.V.K.

Making dinnerware automatically. ANON. *Ceram. Age*, **21** [3], 78–79 (1933). F.G.H.

Employing Habera feldspar for ceramic purposes. HERMANN HARKORT. *Sprechsaal*, **66** [36], 609–11 (1933).—Chemical analysis: 69.0% SiO_2, 18.0% Al_2O_3, 0.05 to 1.00% Fe_2O_3, 0.6% CaO, 10.0% K_2O, 0.7% Na_2O, 2% loss on ignition. The rational composition is 68.4% feldspar, 11.4% clay substance, and 20% quartz. The equivalent composition is

$$\left.\begin{array}{l}0.82\ K_2O\\0.09\ Na_2O\\0.09\ CaO\end{array}\right\}\ 8.9\ SiO_2 \cdot 1.38\ Al_2O_3$$

M.V.K.

Experiments with fine earthenware (Feuerton). M. REITZ. *Tonind.-Ztg.*, **57** [66], 770–71 (1933).—The manufacture of sanitary ware is described. W.M.C.

"Norden" porcelain insulators. ANON. *Danish Foreign Office Jour.*, No. 149, pp. 89–91 (1933).—The Nørden firm is a subsidiary of Bing and Grøndahl of Copenhagen. The difference between the three types of insulators required for high tension, high frequency, and frequency of service is clearly recognized in the plant and in the laboratory. One of the firm's installations was the 220 kw. line over St. Gotthard. H.H.S.

Mechanical and thermal properties of electric insulators. U. RETZOW. *Z. tech. Physik*, **14** [10], 424–28 (1933).—This is a review of data of mechanical and thermal properties published in recent years. Tables are presented for density, strength, thermal expansion, specific heat, and thermal conductivity for basalt, marble, serpentine, mica, shale, asbestos, glass, quartz, china, steatite, sillimanite, stoneware, and compounds. W.M.C.

Effect of mechanical stress on the disruptive strength of dielectrics. ANDREAS GEMANT AND TAKEO AKAHIRA. *Nature*, **132** [3324], 99–100 (1933).—The dilatation of mica under a linear tension perpendicular to the electric force causes a decrease in the disruptive strength. Dilatation of a glass bulb also causes a decrease in the disruptive force, while a compression causes an increase. Bending has no effect. Relieving the stress on the specimens gives a return of the dielectric strength to the original values, *i.e.*, the change is reversible. J.L.G.

High-voltage insulators. DOULTON & CO., LTD. *Elec. Rev.*, **112** [2892], 591 (1933).—The electrical and mechanical testing plant for porcelain insulators recently constructed by Doulton & Co. at their porcelain plant at Lambeth, England, is described. An extra large radio mast rigging insulator tested is capable of withstanding a mechanical pressure of 50 tons without breakdown. The insulator is 12 in. long by 8 in. in diameter and is fluted to guard against electrical leakage. Illustrated with 4 photographs. J.L.G.

Sintered corundum. HANS KOHL. *Keram. Rund.*, **41** [3], 30–33 (1933); see article entitled "Fritted corundum," *Ceram. Abs.*, **12** [10–11], 375 (1933). M.V.K.

British potters discuss silicosis. ANON. *Ceram. Age*, **22** [3], 81–82 (1933).—The elimination of powdered flint as a bedding material and the reduction of flint to a minimum in earthenware bodies were advocated at a recent meeting of the National Council of the Pottery Industry. F.G.H.

Lead in city dust. C. H. MANLEY. *Analyst*, **58**, 471–72 (1933).—Samples of dust from various parts of the city of Leeds showed a maximum of 1.50% Pb, 0.72% Cu, and 0.035% As. H.H.S.

Japanese chinaware importations. ANON. *Ceram. Age*, **22** [4], 111 (1933).—The growth of Japanese importations is described and the attendant danger to domestic business is discussed. F.G.H.

Brief history of the pottery industry of Crooksville, Ohio. G. E. CROOKS. *Ceram. Age*, **22** [4], 117 (1933). F.G.H.

BOOK

Dielectric Phenomena. Vol. III. Breakdown of Solid Dielectrics. S. WHITEHEAD. Ernest Benn, Ltd., London, 1933. Price 30s. Reviewed in *Engineering*, **136**, 186 (1933).—A large amount of hitherto unpublished experimental data is presented. H.H.S.

PATENTS

Apparatus for mounting tile. AUGUST STAUDT. U. S. 1,931,300, Oct. 17, 1933.

Insulator. F. J. STEVENS (Locke Insulator Corp.). U. S. 1,931,626, Oct. 24, 1933. The insulator comprises at least one insulating component and a cementitious mass of aluminate cement associated therewith.

Method and apparatus for molding materials. W. W. TRIGGS (Champion Spark Plug Co.). Brit. 400,280 and 400,281, Nov. 1, 1933.

Equipment and Apparatus

Chart for finding mean specific heat of air and water vapor. JAMES W. MAY. *Heating-Piping*, **5** [9], 475–76 (1933).—M. uses a portion of the Carrier psychrometric chart superimposing the mean specific heat lines upon it. The lines are based on Swann's formula for air, $C_p = 0.24112 + 0.000009T$, and for water vapor on a formula due to W. H. Carrier, *i.e.*, $C_p = 0.4423 + 0.00018T$ (T = temperature in degrees F). Relative humidity lines have been omitted from the chart but the moisture content for air at any condition may be found from the scale marked "grains of moisture per pound of dry air." An example showing the method of finding the mean specific heat of air and water vapor mixtures is given. The entire chart and an enlarged portion of it are shown. J.L.G.

Commercial laboratory equipment. METROPOLITAN-VICKERS ELECTRICAL CO., LTD. *Elec. Rev.*, **112** [2900], 899–900 (1933).—Illustrated. J.L.G.

Microscopic determination of ore-treatment methods. ARTHUR S. HECHT. *Eng. Mining Jour.*, **134** [1], 14–16 (1933).—The use of the microscope in determining the best method of ore treatment is explained. J.L.G.

Pressure regulators—how they work. L. H. BRENDEL. *Power*, **77** [8], 422–23 (1933).—The principles and application of back-pressure and reducing regulators are described and illustrated diagrammatically. F.G.H.

Measurement of opacity and color. ANON. *Amer. Enameler*, **6** [5], 3–4 (1933).—The use of the "Priest-Lange" reflectometer developed at the Bureau of Standards for measurement of whiteness or covering power, as well as color, is described with typical reflectance and color curves. Illustrated. E.J.V.

Multiple interferometer for analyzing vibrations of a quartz plate. H. OSTERBERG. *Phys. Rev.*, **43** [10], 819–29 (1933).—Illustrated by diagrams and photographs of interference patterns from crystals. J.L.G.

Gas analysis apparatus. RODOLFO MARGARIA. *Jour. Sci. Instruments*, **10** [8], 242–46 (1933).—A new type of pipette for gas absorption is described. Illustrated by a diagram of the apparatus and three graphs of per cent absorption against number of passages through the reagent. J.L.G.

One man rotary decorating kiln. ANON. *Ceram. Ind.*, **21** [3], 119 (1933).—Illustrated. E.J.V.

Study of the transmission of heat. K. UHIRA. *Jour. Soc. Mech. Eng.* [Japan], **36** [191], 165–71 (1933); abstracted in *Mech. Eng.*, **55** [8], 514 (1933). F.G.H.

Feldspar and silica processing. A. J. MCDERMID. *Eng. Mining Jour.*, **134** [3], 105 (1933).—The grinding process in use at the Kingman mill of the Consolidated Feldspar Corp. is described with the aid of a flow sheet. Plant capacity per 24 hr. is 100 tons of feldspar or silica to minus 20-mesh or 35 tons to minus 200-mesh. J.L.G.

Reclaiming clay wastes. ANON. *Brit. Clayworker*, **42** [497], 166 (1933).—The collection or precipitation of suspended clay particles by means of cyclone collectors or electrical precipitators is discussed. R.A.H.

Drum-type filter successfully using endless strings and compression. FILTRATION ENGINEERS, INC. *Eng. Mining Jour.*, **134** [2], 84 (1933).—A continuous, automatic drum-type filter that will discharge a cake ranging from $^1/_{32}$ of an inch to 2 inches in thickness without the use of a scraper or blowback is described. The cake is reinforced by endless strings which carry it off the filter after the vacuum has been released. Illustrated. J.L.G.

Proposed American standard for sieves. LEWIS V. JUDSON. *Better Enameling*, **4** [8], 8 (1933); for abstract see *Ceram. Abs.*, **12** [9], 335 (1933). E.J.V.

Operation and maintenance of cloth-screen dust collectors. W. F. TERRY. *Heating-Piping*, **5** [6], 304 (1933).—Points considered are (1) maintenance of arrestor case, (2) design of piping for easy maintenance, (3) care of fans and motors, (4) preventing fire in dust collector systems, and (5) regular general surveys of the plant. See also *Ceram. Abs.*, **12** [12], 429 (1933). J.L.G.

Drying by means of heated air. J. S. JONES. *Fuel Econ. Rev.*, **12**, 67–71 (1933).—An exposition is presented of the process, methods, and equipment used to dry materials by means of heated air. The paper includes an explanation of the improvement of quality of product achieved by control of the humidity, temperature, and quantity of the air circulated in the drier. If quality is the determining factor, drying must be conducted slowly and uniformly with the result that the thermal efficiency is necessarily low. W.E.R.

Flow of fluids in pipes. EMORY KEMLER. *Heating-Piping*, **5** [6], 298–301 (1933).—The flow of incompressible fluids in pipes is discussed. Topics considered are (1) pressure drop in a pipe, (2) viscosity of the fluid, (3) three types of flow problems, (4) establishing the friction factor for different pipes, and (5) noncircular pipes. Illustrated with graphs. See also abstract by Pigott, *Ceram. Abs.*, **12** [10–11], 385 (1933). J.L.G.

Electric brakes for cranes. C. H. S. TUPHOLME. *Elec. Rev.*, **112** [2890], 518–19 (1933).—Electric brakes which are automatically applied upon failure of the supply current on crane motors or upon a break occurring in the armature circuit when lowering under dynamic control are described. Series wound brakes are used to obtain this safety feature. Both a.-c. and d.-c. braking systems are considered. A motor-operated brake is described. All electric brake systems allow remote control with ease and certainty. J.L.G.

Modern line and scrap conveying installation for a converter plant. E. SEILER. *Eng. Progress*, **14** [5], 96–98 (1933).—An automatic car elevator for raising cars from one level to another and an automatic balance for weighing loaded cars are special features of the system. Illustrated by a sketch and five photographs. J.L.G.

Protection of power-shovel equipment against overheating cuts maintenance costs. J. E. BORLAND. *Eng. Mining Jour.*, **134** [6], 250–51 (1933).—Thermostatic protection for windings of motors of power-shovel equipment is advocated. Illustrated. J.L.G.

World's longest bi-cable ropeway. WYLIE L. GRAHAM. *Eng. Mining Jour.*, **134** [7], 287–88 (1933).—A bi-cable, high-speed, continuous rope tramway, 30 miles long, made for the transportation of ore, is described. Details of cable sizes, loads, rope speeds, motors, etc., are given. The Riblet Tramway Co., Spokane, Wash., supplied the equipment. Illustrated. J.L.G.

Lubricating clay dies electrically. ANON. *Elec. Rev.*, **113** [2904], 81 (1933).—A brief account by J. O. Everhart of the use of electricity in lubricating clay dies is given. J.L.G.

Preventing contamination in glaze and clay slip tanks. D. M. WILHELM. *Ceram. Ind.*, **21** [5], 224–26 (1933).—Expanded metal is welded to the inside of the tanks, a protective coat of asphalt is applied, and porcelain blocks, approximately $4^1/_2$ x 9 x $^3/_4$ inches, are laid against the reinforcing with acid-proof cement. The cement squeezing around the expanded metal forms a perfect key making a thoroughly reinforced joint between the lining and the tank. Illustrated. E.J.V.

Vacuum extruding machine. A. HEIL. *Tonind.-Ztg.*, **57** [79], 935 (1933).—This is the description of a new vacuum-operated extruding machine manufactured by Raupach, Görlitz, Germany. W.M.C.

Group or individual drive. A. G. POWELL. *Elec. Rev.*, **112** [2893], 627 (1933).—Group drives will generally have higher maintenance costs than individual drives. This may be balanced by the cheaper running cost of group drives. Illustrated by photographs. J.L.G.

How and where to cut down the power bill. C. N. WITHEROW. *Brick Clay Rec.*, **83** [4], 126–27 (1933).—In discussing causes for heavy power consumption W. points out that equipment in bad repair uses more power due to its inefficiency. Among the heaviest users of power are fans. It is suggested that all plant machinery be checked for condition to minimize excess power loss. E.J.V.

Efficient air compressing. LUCIEN EATON. *Eng. Mining Jour.*, **134** [6], 245–47 (1933).—Air compressing and air compressor systems for operating drills and other intermittently operated mining tools are considered. The standard operating pressures are from 90 to 105 lb./sq. in. Higher pressures would be advantageous except that they cause an unduly high loss from breakage of drills and added maintenance expense. Three types of compressing equipment considered are (1) hydraulic compressors, (2) rotary or turbo compressors, and (3) reciprocating compressors. Illustrated. J.L.G.

Control of electric pumps. F. JOHNSTONE TAYLOR. *Elec. Rev.*, **113** [2910], 276–77 (1933).—Methods of automatic and remote control are discussed. Illustrated by diagrams. J.L.G.

Giant jaw crusher. FRIED. KRUPP GRUSONWERK A.-G. *Eng. Progress*, **14** [8], 155 (1933).—The jaws have a top opening 5.25 ft. wide by 7.2 ft. long. Single rocks or pieces of ore up to 10 tons in weight can be crushed down to the size of a football. From 500 to 800 tons of material can be crushed per hour. The heaviest component of the crusher is the swinging jaw which weighs 40 tons. The two flywheels (10.8 ft. diameter) weigh 13 tons each. The entire crusher weighs 235 tons and is 17 ft. high, 21 ft. long, and 20 ft. wide. Illustrated. J.L.G.

Grinding rollers. F. SIEKMANN. *Tonind.-Ztg.*, **57** [66], 771–72 (1933).—Grinding methods and care of rollers are discussed. W.M.C.

What is the proper method of maintaining correct charge of balls in mills; what is the danger in running an undercharge of balls or frit? J. S. HUNT, T. J. MOULTON, H. M. DOWDS, AND GLENN HUTT. *Enamelist*, **11** [1], 14–15 (1933).—Discussions of these two important questions are presented by each of the authors. E.J.V.

Electrically operated mobile cranes. HENRY J. COLES CO., LTD. *Elec. Rev.*, **113** [2905], 116 (1933).—Three types of electrical controls on moving cranes, *viz.*, (1) plain rheostatic control, (2) throttle control, and (3) a combination of both, are described. Illustrated by two photographs. J.L.G.

Progress in fine grinding. ANON. *Chem. Trade Jour.*,

93 [2409], 53 (1933).—The Hildebrandt mill is capable of grinding hard and soft materials to a fineness of 330-mesh. M.V.K.

Using sandblast machine to produce rough-faced brick of hard materials. ANON. *Brick Clay Rec.*, **83** [4], 131–32 (1933).—As the hard marls and shales used in the North of England for producing a hard surface brick did not readily take the ordinary sanding methods, a sandblast machine was developed to obtain the rough face units so popular in England. A description of the machine is given. Coal is sometimes used instead of sand to produce multicolored effects on the brick when fired. Illustrated. E.J.V.

Sandblasting. ANON. *Ind. Finishing Mag.*, **9** [8], 35–36 (1933).—Uses of the sandblast are briefly enumerated. Various types of sandblasting outfits are mentioned. See also *Ceram. Abs.*, **12** [10–11], 387 (1933). J.L.G.

How to select proper motors for ventilating-fan drives. C. P. HAMILTON. *Power*, **77** [8], 406–408 (1933).—The application of motors to ventilating-fan drives on the basis of their adaptability to speed control, relative cost, power consumption, and quietness is discussed. Illustrated with curves. F.G.H.

Latest developments and improvements in ceramic machinery. GEORG HELM. *Ceram. Ind.*, **21** [3], 124–27 (1933); for abstract see *Ceram. Abs.*, **12** [12], 429 (1933). E.J.V.

Rock drills and accessories. I. LUCIEN EATON. *Eng. Mining Jour.*, **134** [2], 65–68 (1933).—Rock drills and accessories are described and their most advantageous uses indicated. Illustrated by drawings of different types of bits and shanks. **II.** *Ibid.*, **134** [3], 106–109 (1933).—The equipment and operations involved in sharpening and caring for rock drills are considered. J.L.G.

Operating results obtained with Hadsell mill indicate economical reduction. HARLOW HARDINGE. *Eng. Mining Jour.*, **134** [2], 82–84 (1933).—When grinding 178 tons of ore per day the cost of the operation was reported to be $0.195 per ton. This includes power, labor, repairs, and incidentals. The mill can be set to grind to 95% through a 200-mesh screen. Illustrated. J.L.G.

Some notes on chromium plating. ANON. *Ceram. Age*, **22** [4], 127–28 (1933).—Economic aspects of chromium plating in the ceramic industries are discussed from several angles. F.G.H.

Pneumatic machines for application of refractory substances. GUNITOR CO. *Fuels & Fur.*, **11** [4], 155–56 (1933).—New machines have been developed for the pneumatic application of refractory substances, concrete, and cement-sand mixtures. Several different types are made to cover the range of requirements. Illustrated. E.J.V.

Molybdenum-resistance furnace of new design. G. BURROWS. *Jour. Sci. Instruments*, **10** [8], 248–50 (1933).—This electric furnace uses molybdenum resistance strips as the heating elements. These are operated in an atmosphere of hydrogen to protect them from oxidation. The maximum useful operating temperature is limited by the refractories used. By using an alumina tube surrounding four molybdenum resistors running lengthwise through it, and they in turn enclosing a smaller alundum tube, working temperatures of 1850°C can be attained in the inner tube. An input of less than 2 kilowatts is sufficient to raise the temperature of the small furnace described to 1850°C (firing zone about 4 in. long). The use of molybdenum strip instead of the usual molybdenum wire makes for sturdiness and a relatively long life as compared with the wire-wound furnaces. It is proposed to substitute zirconia for the alumina refractory and tungsten for the molybdenum heaters in order to attain temperatures approaching 2500°C. Illustrated. J.L.G.

Electric high-temperature furnaces with heating resistors of ignoble metals. F. LAUSTER. *Eng. Progress*, **14** [8], 157–58 (1933); for abstract see *Ceram. Abs.*, **12** [10–11], 389 (1933). J.L.G.

Wire for resistance furnaces. A. G. AREND. *Elec. Rev.*, **113** [2909], 248 (1933).—The majority of wire used in electric furnaces for use at temperatures around 1000°C is a nickel-chromium alloy of varying proportions. A widely used alloy for small furnaces is 80% nickel and 20% chromium. Reducing the chromium content raises the melting point but reduces the temperature at which the winding can be used without deterioration. The method of fusing the metal, casting the ingots, rolling them into rods, annealing, cleaning, and pickling the rods, and finally drawing the wire is described. J.L.G.

Wear of metal in muller tires in the clay industry. J. MAYER. *Bull. Amer. Ceram. Soc.*, **12** [11], 312–13 (1933); see *Ceram. Abs.*, **12** [2], 72 (1933).

BOOKS AND BULLETIN

Practical Microscopy. L. C. MARTIN AND B. K. JOHNSON. Blackie's Technique Series. vii + 116 pp., 10 plates. Blackie & Son, Ltd., London, Glasgow, and Bombay, 1931. 3s 6d net. Briefly reviewed in *Nature*, **132** [3322], 10 (1933).—The book explains the constructional details and possibilities of the microscope. The lens, illumination problems, the stand and mechanical parts, preparation of specimens, polarized light, photomicrography, and ultra-violet microscopy are among the subjects treated. Illustrated. J.L.G.

Fan Engineering. Edited by R. D. MADISON AND W. H. CARRIER. Reviewed in *Mech. Eng.*, **55** [9], 590 (1933); for abstract see *Ceram. Abs.*, **12** [10–11], 387 (1933). F.G.H.

The Science and Practice of Drying. A. E. BROWN. 154 pp. Reviewed in *Ceram. Age*, **22** [4], 117 (1933); for abstract see *Ceram. Abs.*, **12** [9], 336 (1933). F.G.H.

Performance of propeller fans. A. I. BROWN. *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 77, 34 pp.; *Power*, **77** [10], 547 (1933). F.G.H.

BOOK REVIEW

Measurement of High Temperatures by Pyrometers. V. PARVITSKY. State Technical Theoretical Publishing Co., Leningrad, 1933. 64 pp. 47 figs. Price 1R 80k. This brochure contains data on the design and use of thermoelectric and optical pyrometers and other devices for temperature control, *e.g.*, Seger cones, etc. The appendix gives two projects of All-Union Standards, (1) for technical pyrometers, and (2) for thermoelectric pyrometers with platinum platinum-rhodium thermocouples. S.I.PERKAL

PATENTS

Centrifugal machine. L. D. JONES (Sharples Specialty Co.). U. S. 1,931,496, Oct. 24, 1933.

Tile cutting and breaking machine. S. I. GRANITE. U. S. 1,932,659, Oct. 31, 1933.

Means for continuously manufacturing building brick, etc. FERDINAND FANTA. U. S. 1,933,051, Oct. 31, 1933.

Electrical means for testing translucent materials. R. S. GLASGOW AND A. L. D. D'ADRIAN. U. S. 1,934,187, Nov. 7, 1933.

Machines for sifting potters' slip and other granular or pulverulant materials. A. C. HARRISON, F. D. BOULTON, AND F. BEARDMORE. Brit. 399,293, Oct. 11, 1933.

Kilns, Furnaces, Fuels, and Combustion

Fuel analysis. G. S. SCOTT. *Ceram. Age*, **21** [5], 149–50 (1933). F.G.H.

Elimination of solid matter from flue gases. ANON. *Steam Engineer*, **2** [6], 264–67 (1933); abstracted in *Mech. Eng.*, **55** [6], 385 (1933).—Several types of dust-extraction systems are described and their application is discussed in detail. F.G.H.

Losses of volatile matter in coal by standard method. Water of hydration and carbon dioxide of mineral matter. W. A. SELVIG AND W. D. POHLE. *Ind. Eng. Chem., Anal. Ed.*, **5** [4], 239–41 (1933). F.G.H.

Lighting pulverized coal safely. ANON. *Power*, **77** [9], 463 (1933).—A device for the safe lighting of pulverized coal, oil, and gas burners is described and illustrated. F.G.H.

Evolution in firing with pulverized coal. A. C. *Rev. gen. sci.*, No. 1; abstracted in *Rev. mat. constr. trav. pub.*, No. 280, pp. 15–16*B* (1933).—A general discussion of the advantages of using pulverized coal for firing and methods for pulverizing it is given. M.V.K.

Fuel gases. ANON. *Power*, **77** [4], 194 (1933).—Four fuel gas charts are presented on *Power's* data sheet No. 9. F.G.H.

Use of gas for pottery firing. ALEXANDER MACKAY. *Brit. Clayworker*, **42** [497], 182–84 (1933).—In actual practice it has been found that with the adoption of gas firing of kilns the production has been considerably speeded up. The wear and tear on kiln mouths, flues, saggers, and the refractories in general is negligible with gas firing compared with coal firing owing to the lack of iron dust. In most cases it is possible to reduce the time required for any firing operation and this has a direct bearing on labor charges. With the gas-fired furnace the use of saggers is in many cases rendered unnecessary. The use of props and bats instead of saggers has the following advantages: (1) the weight ratio of bats and props to ware is 1:1 compared to 10:1 with saggers thereby permitting more ware to be fired; (2) less fuel is required in heating up accessory refractories; (3) the ware is heated more uniformly because of more accurate temperature control; (4) the ware is heated more quickly; (5) it is not discolored; and (6) two stages of firing can be reduced to one. See also *Ceram. Abs.*, **12** [10–11], 392 (1933). R.A.H.

Flue gas heat losses when oil is the fuel. N. C. EBAUGH. *Power*, **77** [3], 128–29 (1933).—Charts are presented for the determination of the per cent heat loss in oil-fired furnaces. One chart can also be used to check the accuracy of flue-gas analyses. F.G.H.

Coal-dust firing. ANON. *Tech. Blätter*, **22**, 438–39 (1932); abstracted in *Feuerungstechnik*, **21** [6], 94–95 (1933).—A method for employing raw coal dust with a grain size up to 4 mm. is described. M.V.K.

Anthracite duff as boiler fuel. INTERNATIONAL COMBUSTION, LTD. *Elec. Rev.*, **112** [2896], 739 (1933).—Pulverized fuel feeders and equipment designed to burn the waste screening from the South Wales anthracite mines are described and shown diagrammatically. Ninety-five per cent of the material passes a $^1/_8$-mesh and 30% passes a 50-mesh screen. Two hundred tons of such fuel were recently burned successfully. J.L.G.

Advantage of clean coal to industry. R. A. MOTT. *Fuel Econ. Rev.*, **12**, 6–8 (1933).—M.'s object is to show that it is worth while for the consumer to offer a monetary inducement for the preparation of coals of lower ash content. W.E.R.

Development of low-temperature carbonization during 1932. F. S. SINNATT. *Fuel Econ. Rev.*, **12**, 4–5 (1933).—The Pittsburgh Coal Co. has arranged to develop the Illingworth Process in the U.S. The Scottish Gas Utilities Corp., Ltd., has, for more than two months, supplied gas from low-temperature retorts to the Glenboig Union Fire Clay Co., Ltd., where the use of the gas in brick kilns has proved satisfactory. The Fuel Research Board has perfected a system of vertical firebrick "slot" retorts to replace cast-iron retorts. The retorts are made of ordinary fire brick, and because the temperature is relatively low, the depreciation should not be high. W.E.R.

Investigating reactions taking place in gas generators. RUDOLF LEHMAN. *Glashütte*, **63** [16], 270 (1933).—Investigations of reactions occurring in a generator with a revolving grate are described in detail. The composition of the gas present in different layers in the generator is given in a table. Such an analysis gives a clear picture of combustion and reduction processes in the generator. M.V.K.

Klein's gas generator and its use in ceramics. CURT KABUS. *Keram. Rund.*, **41** [2], 15–18 (1933).—A gas producer for periodically operated furnaces, especially when comparatively small amounts of fuel are gasified, is described in detail. Illustrated. See also *Ceram. Abs.*, **12** [6], 239 (1933). M.V.K.

Combustible gas analyzer. BACHARACH INDUSTRIAL INSTRUMENT CO. *Power*, **77** [8], 440 (1933).—An instrument is described which measures combustible components of gaseous mixtures continuously and automatically. It operates on the principle of combustibles burning catalytically along a heated resistance wire which forms one arm of a Wheatstone bridge. Illustrated. F.G.H.

Brief review of modern applications of heat to various

nonferrous furnaces. GILBERT EVANS. *Metal Ind.* [London], **43** [10], 215–18; [11], 239–41 (1933).—The paper deals with reheating and annealing furnaces. M.V.K.

Economical maintenance of large electric furnaces. ANON. *Machinery* [London], **42**, 127 (1933).—A heating element for an electric resistance furnace is in the form of a long hairpin attached by nuts to busbars at the back of the furnace. It can be replaced in a few minutes even when the furnace is hot. F.G.H.

Ceramic heating elements for electric furnaces. L. LITINSKY. *Feuerfest*, **9** [4], 49–54 (1933).—After a short description of heating elements made of carbon, noble metals, metallic oxides, alundum, magnesium oxide, nitrides, and carbides, the advantages of employing silicon carbide for electric furnaces are pointed out. Difficulties encountered with bonding agents for molding silicon carbide and particulars about Silundum, Siloxicon, and Silite-II heating rods are given. The chemical, physical, and electrical properties of Silite heating rods are discussed in detail. Details on the chemical, physical, and electrotechnical properties of Globar heating elements and data on their employment in glassmelting and porcelain firing furnaces are described. M.V.K.

Commercial burners for underwater fires. K. A. KOBE AND C. W. HAUGE. *Power*, **77** [8], 402–403 (1933).—Fuel and air mixed homogeneously pass to the burner at a rate greater than the rate of flame propagation, thus preventing backfiring. The burner refractory surface becomes incandescent, thus insuring complete combustion. If heat flows away fast enough the refractory will not fuse. The heat flow must not be so fast that the refractory will cool below the ignition temperature. Illustrated with diagrammatic sketches. F.G.H.

Oil measurement table at 60°F. ANON. *Power*, **77** [9], 474 (1933).—*Power's* data sheet No. 13. F.G.H.

Burner for creosote oil. ANON. *Engineer*, **156** [4048], 144 (1933).—The design and operation of the Brett burner for the atomization and burning of creosote oil in industrial furnaces is described and illustrated. F.G.H.

How to select the right oil burners. H. J. KLOTZ. *Power*, **77** [4], 212 (1933).—Various factors involved in the selection of oil burners are discussed. F.G.H.

Steam-atomizing burner. BABCOCK AND WILCOX CO. *Power*, **77** [7], 385 (1933).—A steam-atomizing burner for firing heavy oil, tar, and pitch is described. Illustrated. F.G.H.

Maintenance of the ring kiln is equivalent to its efficiency. DIETRICH. *Tonind.-Ztg.*, **57** [75], 885 (1933).—The importance of keeping the ring kiln in good repair is outlined. W.M.C.

Increasing the output of existing kilns. ANON. *Brit. Clayworker*, **42** [497], 180 (1933).—In the case of some continuous kilns an increase of 4000 to 6000 brick per week may be obtained by fitting a suitable system of hot-air flues and fans for drying and warming the brick in the kiln to a temperature of 120°C or above. It is the first stage which reduces the output of the kiln and if it can be controlled independently of the burning, especially if the steam produced in this stage can be removed by a fan and not sent into the main flue, the output of the kiln can be increased. Owing to the lack of control in many continuous kilns, the carbonaceous matter is burned out far more slowly than it need be and this further reduces the output. R.A.H.

Relative costs of kilns. FELIX SINGER. *Brit. Clayworker*, **42** [496], 143 (1933); for abstract see *Ceram. Abs.*, **12** [7], 273 (1933). R.A.H.

Means for firing ceramic ware. ANON. *Keram. Rund.*, **41** [11], 134–36 (1933).—Practical devices for improving the firing of ceramic ware are discussed. M.V.K.

Fuel economy in the ceramic industries. J. A. AUDLEY. *Fuel Econ. Rev.*, **12**, 65–66 (1933).—The substitution of elaborate and costly kilns fired by electricity, gas, and oil for the less costly kilns formerly in general use with cheap coal has progressed despite the dullness of business. The cost has been compensated by increased efficiency and low charges for maintenance. Because of fluctuations of business the capacity of a single continuous kiln should be limited to less than half the output of the plant. Attention to the cleanliness of heat-absorbing surfaces in steam boilers is set forth as an important source of economy of fuel in ceramic plants, one plant having saved more than $1000 by this means in nine months. W.E.R.

Firing brick with waste fuel. W. MATTHES-GLIENICK. *Tonind.-Ztg.*, **57** [80], 940–41 (1933).—Costs of firing common brick are calculated using ordinary grades of coal and waste coal and briquet. Waste fuels or mixtures of waste and ordinary coal are recommended for many products. W.M.C.

Recuperating heat from the ring kiln. E. SCHIRM. *Tonind.-Ztg.*, **57** [78], 919–20; [80], 944–46 (1933).—Several types of ring kilns are shown. Conduits for recuperating the heat may be built in masonry in different parts of the kilns, or steel pipes may be used for the same purpose. W.M.C.

Tunnel kiln for magnesite burning. ANON. *Stroitel. Material.*, No. 11, pp. 52–54 (1931); *Feuerfest*, **9** [4], 54–56 (1933).—A pressure-gas and oil-fired tunnel kiln for temperatures up to 1700°C is described. The kiln is used for firing magnesite in Satka (Ural). Illustrated. M.V.K.

Gas kilns have broadened the potter's art. J. B. NEALEY. *Ceram. Age*, **22** [3], 71–73 (1933).—The application of gas-fired tunnel kilns in both the bisque and glost firing of vitrified hotel chinaware is described and illustrated. F.G.H.

Care of ceramic furnaces. HANS KREMSKI. *Keram. Rund.*, **41** [16], 201–203 (1933).—K. discusses refractoriness, resistance to temperature changes, thermal conductivity, resistance to chemical attack, refractory mortars, removal of visible defects in the furnace masonry, formation of cracks, and crowns and brick falling out. M.V.K.

Thermometry in the glass industry. I. ANON. *Rev. belge ind. verrières, céram., émail.*, **4** [8], 175–77 (1933).—The theoretical bases of thermometry and the apparatus employed for the supervision of furnaces, including Seger cones and dilatation and electric thermometers, are described in detail. M.V.K.

Efficient use of pyrometric cones demands care and judgment. H. B. HENDERSON. *Ceram. Age*, **22** [4], 98–122 (1933).—Four cone groups, correlated with groups of ware for which the cones are used, are described.

The making of cone plaques is discussed and various methods of cone placing are considered. The intelligent use of cones as indicators of adverse firing conditions is stressed. Illustrated. F.G.H.

BOOKS AND BULLETIN

Technical Measurements. (Technische Messungen.) A. GRAMBERG. Julius Springer, Berlin, 1933. 488 pp. Price 24 Rm. Reviewed in *Power*, **77** [9], 495 (1933).—Chapters on quantity of heat, the calorimetry of fuels, and gas analysis are included in this volume. F.G.H.

Industrial Electric Heating. N. R. STANSEL. *Jour. Inst. Metals*, **53** [5], 286 (1933); for abstract see *Ceram. Abs.*, **12** [10–11], 393 (1933). F.G.H.

Heat and Its Workings. M. MOTT-SMITH. D. Appleton & Co., 1933. 240 pp. Price $2.00. Reviewed in *Foundry*, **61** [7], 72 (1933). F.G.H.

Method of determining values of different fuels for power plant use. H. M. FAUST. *Ohio State Univ. Eng. Expt. Sta. Circ.*, No. 29, 8 pp.; *Power*, **77** [6], 321 (1933). F.G.H.

PATENTS

Tunnel or enameling pottery kiln. W. J. MILLAR (Ajax Electric Co., Inc.). U. S. 1,934,870, Nov. 14, 1933.

Clay products processing machine. E. M. HOOVER. U. S. 1,935,319, Nov. 14, 1933. A tunnel for the firing of clay products is combined with a preheating tunnel inclined upward away from the firing tunnel and adapted to receive exhaust heat and gases therefrom, a conveyer for moving clay products through the preheating tunnel and having its carrying stretch substantially above the exhaust opening of the firing tunnel, a conveyer through the firing tunnel, and means for transferring the clay products from the preheating tunnel conveyer to the firing tunnel conveyer.

Tunnel kilns. GIBBONS BROTHERS, LTD., AND W. E. GIBBONS. Brit. 400,496, Nov. 1, 1933.

Geology

Ore deposits of the United States in their relation to geologic cycles. B. S. BUTLER. *Econ. Geol.*, **28** [4], 301–28 (1933).—The Pre-Cambrian, Appalachian Paleozoic, Cordilleran, and Rocky Mountain cycles and their deposits are given detailed consideration. The Atlantic and Pacific coast belts are compared. Illustrated by seven maps. J.L.G.

Note on discovery of kaolin deposit in New Mexico. L. M. RICHARD. *Jour. Amer. Ceram. Soc.*, **16** [12], 632–33 (1933).

Canadian Kaolin Silica Products, Limited. W. M. GOODWIN. *Can. Mining Jour.*, **54** [10], 377–80 (1933).—The plant, operating methods, and products of the only kaolin producer in Canada are described. The quarry and mill at Lac Remi, Quebec, also produces silica. G.M.H.

Lithium deposits. ANON. *Ind. chimique*, **20** [233], 467 (1933).—Very important lithium deposits are being mined in Australia. These deposits consist of phosphate of lithium and aluminum (ambligonite) containing from 8 to 9% lithium. Besides the manufacture of metallic lithium, lepidolite is extensively employed in the glass, enamel, and porcelain industries. M.V.K.

Composition and origin of certain commercial clays of northern Idaho. EDWARD L. TULLIS AND F. B. LANEY. *Econ. Geol.*, **28** [5], 480–95 (1933); for abstract see *Ceram. Abs.*, **12** [1], 33 (1933). J.L.G.

Investigation into the clays of Punjab. J. L. SARIN. *Jour. Indian Ceram. Soc.*, **4** [1], 8–16 (1932). A.A.

Manganese, its ores, properties, and uses. ROBERT RIDGWAY. *Metallurgia*, **8** [46], 111–13 (1933); *Metal Ind.* [London], **43** [4], 83–85 (1933). M.V.K.

Processing witherite. H. CONRAD MEYER. *Eng. Mining Jour.*, **134** [7], 283–84 (1933).—The ore-dressing process of the Settling-Stones mines near Hexham, England, is described. Illustrated. J.L.G.

Feldspar in a period of change. O. BOWLES AND C. W. JUSTICE. *Ceram. Age*, **21** [4], 110–11 (1933). F.G.H.

Pegmatites. FRANK L. HESS. *Econ. Geol.*, **28** [5], 447–62 (1933).—The geology and minerals of each type of pegmatite are considered both generally and with reference to particular localities. Minerals of economic importance found only in pegmatites are massive potash and soda feldspars, large clear quartz crystals, cryolite, columbium and tantalum minerals, beryllium minerals, gem tourmalines, sheet mica, primary lithium, rubidium, and cæsium minerals, and uraninite and yttria minerals. Many other minerals occurring elsewhere may and do occur extensively in pegmatites. J.L.G.

Chalcocite and native copper types of ore deposits. EDSON S. BASTIN. *Econ. Geol.*, **28** [5], 407–46 (1933).—The geology, geographical occurrence, and chemical composition of deposits of chalcocite and native copper ore are considered. A bibliography of 43 titles is appended. Illustrated with maps and graphs. J.L.G.

Beryllium minerals in Brazil. LUCIANO J. MORAES. *Econ. Geol.*, **28** [3], 289–92 (1933).—The best known and most productive deposits of beryl minerals in Brazil occur in southern Bahia and eastern Minas Geraes. M. lists the localities and the particular varieties of the minerals found there. J.L.G.

Manganese mining and milling in the Cartersville District of Georgia. GEOFFREY W. CRICKINAY. *Eng. Mining Jour.*, **134** [5], 204–206 (1933).—The geology of the region and the mining and milling of the ore are discussed. Illustrated. J.L.G.

Australian laterite as bauxite. ANON. *Christian Sci. Mon.*, **25** [230], 4 (1933). E.J.V.

Cause of brittleness in chrysotile asbestos. N. D. SOBOLEFF AND M. V. TATARINOFF. *Econ. Geol.*, **28** [2], 171–77 (1933).—Brittle asbestos is a transition stage between talc and normal asbestos and not between serpentine and normal asbestos. J.L.G.

Compressibility and anisotropy of rocks at and near the earth's surface. W. A. ZISMAN. *Proc. Nat. Acad. Sci.*, **19** [7], 666–79 (1933).—Z. determines the magnitude of

the effect of anisotropy of rocks on compressibility determinations (seismological data) using a piezometer which is described and illustrated in the article. J.L.G.

Comparison of the statically and seismologically determined elastic constants of rocks. W. A. ZISMAN. *Proc. Nat. Acad. Sci.*, **19** [7], 680–86 (1933).—Laboratory measurements of compressibilities of uncovered rocks agree closely in every case with seismological measurements on these rock masses. For covered masses agreement is not as good due to cracks and cavities. J.L.G.

Thin sections of weathered rocks. THOMAS CLEMENTS. *Eng. Mining Jour.*, **134** [3], 99 (1933).—Instructions are given for making thin sections of weathered rocks. It is essential that soft friable rocks be thoroughly impregnated with balsam before the final grinding can be completed successfully. J.L.G.

Field instruments. D. C. GALL. *Jour. Sci. Instruments*, **10** [7], 197–203 (1933).—The choice and special construction of electrical instruments for field use are considered. Illustrated. J.L.G.

Young's modulus and Poisson's ratio with reference to geophysical applications. W. A. ZISMAN. *Proc. Nat. Acad. Sci.*, **19** [7], 653–65 (1933).—Young's modulus and Poisson's ratio are used in geophysical determinations made from seismological data. Apparatus and methods used are described. Illustrated by diagrams. J.L.G.

Seismographic methods for determining crustal structure. B. GUTENBERG, H. O. WOOD, AND J. P. BUWALDA. *Nature*, **132** [3327], 212–13 (1933).—The methods employed in a seismic exploration of the earth's crust at five places in California during 1931 are described. J.L.G.

Classification and nomenclature of rock units. Symposium. *Bull. Amer. Assn. Petroleum Geol.*, **17** [7], 843–63 (1933).—Rules and suggestions are given. G.M.H.

Geophysical earth tester. EVERSHED AND VIGNOLES, LTD. *Jour. Sci. Instruments*, **10** [6], 185–87 (1933).—Earth resistivity methods of geophysical surveying have been found of considerable service in the determination of the depth of underlying strata and in similar problems. Small values of electrical resistance must be measured which are often less than 0.1 ohms when measurements to depths of 500 to 1000 feet or more are involved. A sensitive "megger" earth tester is described. It is equipped with two ranges, 0.0 to 0.3 and 0.0 to 3.0 ohms. Illustrated by diagrams. J.L.G.

BOOKS AND BULLETINS

Igneous Rocks and the Depths of the Earth. R. A. DALY. McGraw-Hill Book Co., New York and London. 598 pp. Price $5.00. *Mining & Met.*, **14** [323], 3 (1933).—The first part considers the leading facts known about eruptive rocks, particularly the facts relating to field relations, the second gives a general eclectic "theory of the earth," and the third sketches the application of this theory to the separate major groups of eruptive rocks. E.J.V.

Outlines of Mineral Paragenesis. (Grundriss der Mineralparagenese.) FRANZ ANGEL AND RUDOLF SCHARIZER. xii + 293 pp. Julius Springer, Vienna and Berlin, 1932. 19.80M. Briefly reviewed in *Nature*, **132** [3323], 48 (1933).—There are four sections. The first is a general discussion of organic and inorganic substances and of the structure and composition of the earth as a whole. The next three treat the rock-forming minerals and their genesis, the minerals of ore deposits, and the materials of the biosphere. The genetical aspect is stressed as are also the typical associates of individual species. See also *Ceram. Abs.*, **12** [8], 310 (1933). J.L.G.

Practical Treatise on Geophysical Prospecting. (Traité Pratique de Prospection Géophysique.) C. L. ALEXANIAN. 268 pp. Illustrated. Librarie Polytechnique Ch. Beranger. Reviewed in *Eng. Mining Jour.*, **134** [4], 165 (1933).—Gravimetric, magnetic, electric, seismic, geothermal, and radioactive methods of prospecting are considered. The treatment is theoretical and formulas are developed mathematically. J.L.G.

Geological and Mining Studies by Geophysical Methods. (Études Géologiques et Prospections Minières par les Méthodes Géophysiques.) P. GEOFFROY AND P. CHARRIN. Geological Survey of Algeria. 4th Series, Geophysics, No. 1, 346 pp. Illustrated. Reviewed in *Eng. Mining Jour.*, **134** [4], 165 (1933).—The treatment stresses the practical rather than the theoretical side of geophysical prospecting. J.L.G.

Textbook of Geology. II. Historical Geology. CHARLES SCHUCHERT AND CARL O. DUNBAR. 3rd ed., largely rewritten. 551 pp. John Wiley & Sons, New York, 1933. Price $4.00. Reviewed in *Bull. Amer. Assn. Petroleum Geol.*, **17** [9], 1148 (1933). G.M.H.

Winning of clays and shales. J. F. MCMAHON. *Can. Mining Met. Bull.*, No. 258, pp. 495–523 (1933).—Clay gathering by surface operation in Quebec and Ontario, Canada, was investigated. The following subjects are discussed in detail: (1) factors affecting the method of operation, (2) deposits operated both in flat and hilly country, (3) problems and methods of operation, (4) unskilled labor *vs.* mechanical devices which require skilled labor, (5) machinery and equipment used, (6) methods of transportation, and (7) cost data. G.M.H.

Cyanite in Virginia. A. I. JONAS AND J. H. WATKINS. *Va. Geol. Surv. Bull.*, No. 38; *Eng. Mining Jour.*, **134** [6], 237 (1933).—J. considers the geology of the cyanite belt while W. discusses the economic aspects of the mineral. J.L.G.

Abstracts of current articles on geophysical prospecting. F. W. LEE. Bur. Mines *Periodical Service Rept.*, GA 52, 21 pp. GA 53, 23 pp. 10¢ each. See also *Ceram. Abs.*, **12** [10–11], 398 (1933). R.A.H.

Potash. B. L. JOHNSON. Bur. Mines *Economic Paper*, No. 16, 78 pp. This report is a comprehensive summary of the potash situation from the domestic standpoint and is a valuable contribution in view of the importance of making the United States independent of foreign potash monopoly. R.A.H.

Feldspar in 1932. ANON. Bur. Mines *Metal Market Repts.*, MMS 219, 2 pp. R.A.H.

Handbook of Geophysics. (Handbuch der Geophysic.) Published by B. GUTENBERG. Vol. 2, Part 2. The Geological Structure of the Earth. A. BORN. v + 565–867 pp. 69M. Vol. 4, Part 3. Geography of Earthquakes (Erdbebengeographie). A. SIEBERG. iv + 687–1005 pp. 84M. Vol. 9, Part 1. The Structure of the Atmosphere. B. GUTENBERG. Propagation of Sound

in the Atmosphere (Die Schallausbreitung in der Atmosphäre). B. GUTENBERG. Heat Balance of the Stratosphere (Wärmehaushalt der Stratosphäre). Part 1, J. TICHANOVSKI. Part 2, R. MUGGE. v + 171 pp. 36M. Gebrüder Borntraeger, Berlin, 1932. Briefly reviewed in *Nature*, **132** [3322], 10 (1933).—All the accounts are very thorough. J.L.G.

Study of properties of Texas–New Mexico polyhalite pertaining to the extraction of potash. VII. Effect of particle size, sodium chloride concentration, and temperature upon hot extraction by a multistage process. J. E. CONLEY AND F. FRASS. Bur. Mines *Rept. of Invest.*, No. 3210, 29 pp. Free. The report discusses experiments performed to ascertain when a continuous countercurrent extraction of calcined polyhalite by hot water will yield satisfactory recoveries and concentrations of potassium sulfate in the top liquor. Good results were obtained with −35 +100-mesh, −20-mesh, and −10-mesh sizes. For Part VI see *Ceram. Abs.*, **11** [9], 501 (1932). R.A.H.

Mineral Industries of Pennsylvania. RAYMOND E. MURPHY. Greater Pennsylvania Council, Harrisburg, Pa. 185 pp. Price $1.00. *Mining & Met.*, **14** [323], 468 (1933).—About half of the book is devoted to fuels, both anthracite and bituminous, with an intelligent and well balanced survey of petroleum and natural gas. Iron and steel are next in importance followed by rock, lime, clay, and cement. E.J.V.

Geology of South America. Part I. (Geologie Südamerikas.) H. GERTH. vii + 198 pp. 17 tables, 38 figs. Gebrüder Borntraeger, Berlin, 1933. Cloth, 22Rm. Reviewed in *Bull. Amer. Assn. Petroleum Geol.*, **17** [10], 1283–84 (1933). G.M.H.

Chemistry and Physics

Methods used in the analysis of lead alloys. B. S. EVANS. *Analyst*, **58**, 450–61 (1933).—Procedure is described for Pb, Sb, Cd, Ba, Ce, Tl, Te, and Ni determinations. H.H.S.

Analytical sensitivity of the Debye-Scherrer method and the possibilities of its use in quantitative analysis. M. PAIC. *Arhiv Hem. Farm.*, **7** [5], 143–46 (1933). E.J.V.

Determination of copper, iron, zinc, and aluminium in presence of each other. R. LANG AND J. REIFER. *Z. anal. Chem.*, **93**, 161–72 (1933); abstracted in *Analyst*, **58**, 496–97 (1933). H.H.S.

Magneto-optic nicol rotation method for quantitative analysis of calcium. E. R. BISHOP, C. B. DOLLINS, AND I. G. OTTO. *Jour. Amer. Chem. Soc.*, **55** [11], 4365–70 (1933); see also *Ceram. Abs.*, **12** [4], 171 (1933). F.G.H.

Determination of selenium. W. O. ROBINSON. *Jour. Assn. Official Agric. Chem.*, **16**, 423–24 (1933).—Se is separated from all elements except As and Ge by distillation of the chloride or bromide (preferably the latter) and is then precipitated in the red form by hydroxylamine hydrochloride. H.H.S.

Quantitative analysis by spectroscopic methods. O. S. DUFFENDACK, R. A. WOLFE, AND R. W. SMITH. *Ind. Eng. Chem., Anal. Ed.*, **5** [4], 226–29 (1933). F.G.H.

Microanalysis of gases. II. Carbon monoxide, ethylene, and acetylene. F. E. BLACET, G. D. MACDONALD, AND P. A. LEIGHTON. *Ind. Eng. Chem., Anal. Ed.*, **5** [4], 272–74 (1933). F.G.H.

Volumetric determination of cobalt by means of ferrous sulfate and potassium dichromate. L. A. SARVER. *Ind. Eng. Chem., Anal. Ed.*, **5** [4], 275–76 (1933). F.G.H.

Asbestos in permanganate titrations. R. W. CURTIS AND J. FINKELSTEIN. *Ind. Eng. Chem., Anal. Ed.*, **5** [5], 318–19 (1933).—In the determination of calcium by the titration of oxalate ion by potassium permanganate, filter paper reacts to an appreciable extent while asbestos does not react. The presence of the asbestos in suspension also provides a background in the solution which makes the detection of the end point easier. F.G.H.

Silicon tetrafluoride volatilization. W. D. ARMSTRONG. *Ind. Eng. Chem., Anal. Ed.*, **5** [5], 315–17 (1933). F.G.H.

Determination of fluorine in cryolite. F. J. FREERE. *Ind. Eng. Chem., Anal. Ed.*, **5** [1], 17–18 (1933).—A volumetric method is outlined for the determination of fluorine in cryolite, using yttrium nitrate as a reagent. Cerous nitrate is recommended as a reagent for the determination of fluorine in glasses. F.G.H.

Determination of traces of lead. J. H. HAMENCE. *Analyst*, **58**, 461–64 (1933).—The colorimetric estimation of Pb is interfered with by Bi. It was found that Bi could be removed by adding 2 cc. saturated NH_4CNS solution and 1 cc. pyridine, and then extracting with 15 cc. ether and 15 cc. amyl alcohol. See also *Ceram. Abs.*, **12** [3], 130 (1933). H.H.S.

Isotopic fractionation of water. EDWARD W. WASHBURN, EDGAR R. SMITH, AND MIKKEL FRANDSEN. Bur. Stand. *Jour. Research*, **11** [4], 453–62 (1933); R.P. 601.—When water is subjected to electrolysis an isotopic fractionation takes place, the evolved hydrogen being richer in the H^1 isotope and the evolved oxygen richer in the O^{18} isotope than is the water from which they were evolved. If the gases resulting from the electrolysis of water are recombined, the water produced has a lower density than the water from which they were evolved. The residual water grows progressively more dense as the electrolysis proceeds, owing to the increasing concentration of the H^2 isotope of hydrogen and, to a less extent, of the O^{18} isotope of oxygen. Curves illustrating the efficiency of the fractionation process are given. Substantially pure H^2, pure H^1, and pure O^{16} can be obtained by the fractionation process. The heavy water obtained by the process has a higher freezing point, a higher boiling point, and a lower refractive index than normal water. A differential pycnometer method for measuring specific gravity, accurate to 1 part in a million, is described. R.A.H.

Theory of real crystals. ADOLF G. SMEKAL. *Phys. Rev.*, **44** [4], 308–309 (1933).—S. defends his "imperfection" theory in crystals against Zwicky's theory of secondary structure. J.L.G.

Analysis of Slater's compressibility data. H. M. EVJEN. *Phys. Rev.*, **44** [6], 491–500 (1933).—A mathematical discussion of the relations connecting interatomic forces and interatomic distances in crystals with the compressibility is given. J.L.G.

Contribution to the theory of heteropolar crystals. H. M. EVJEN. *Phys. Rev.*, **44** [6], 501–509 (1933).—Theories for explaining the stability of ideal crystals are discussed and a form of Zwicky's secondary structure is advocated as a basis for a theory of the solid state. J.L.G.

Plasticity of rock salt and its dependence upon water. R. BOWLING BARNES. *Phys. Rev.*, **43** [1], 82–83 (1933).—B. shows by infra-red absorption of the soaked crystal that the water has been absorbed uniformly through the crystal and that this condition is characteristic of its plasticity. B. believes the water enters the crystal along crevices between the minute mosaic blocks postulated by Zwicky and Smekal. J.L.G.

Plasticity of rock salt and its dependence upon water. ADOLF G. SMEKAL. *Phys. Rev.*, **43** [5], 366–67 (1933).—S. does not consider this as indicating a connection with the secondary structure postulated by Zwicky for rock salt and other alkali halides. J.L.G.

Plasticity of crystals. F. ZWICKY. *Phys. Rev.*, **43** [9], 765–66 (1933).—Z. maintains, against A. Smekal's views, that certain effects in crystals, such as the plasticity of sodium chloride crystals soaked in water, can not be explained by assuming microscopic cracks and imperfections but must be accounted for by a regular secondary structure in the crystal along the lines of which the plasticizing water enters the crystal. J.L.G.

Index of refraction of water and its thermal history. VICTOR R. LA MER AND M. L. MILLER. *Phys. Rev.*, **43** [3], 207–208 (1933).—No change was found in indices after various thermal treatments. J.L.G.

Theory of depolarization, optical anisotropy, and the Kerr effect. ROBERT SERBER. *Phys. Rev.*, **43** [12], 1003–10 (1933).—The theories are developed mathematically. J.L.G.

Application of quartz spectrograph to study of opaque minerals. MAURICE HALL HAYCOCK. *Econ. Geol.*, **28** [4], 364–82 (1933).—The use of the quartz spectrograph is explained in identifying small amounts of unknowns in opaque ores. Results of its application in the case of a group of previously undeterminable minerals in silver-lead ores from Alaska are given. Illustrated by drawings, photographs, and photomicrographs. J.L.G.

Gel formation in sodium metasilicate solutions. M. J. PRUCHA AND C. A. GETZ. *Ind. Eng. Chem.*, **25** [1], 68–72 (1933).—The following factors and combinations of them are discussed as to their influence on gel formation in sodium metasilicate solutions: (1) addition of lactic acid; (2) addition of other alkaline washing powders; (3) addition of sour milk and sweet skim milk; (4) gel formation in other alkaline washing solutions in presence of milk; (5) addition of other alkaline washing powder, sour milk, and milk solids; (6) effect of agitation; and (7) effect of temperature. F.G.H.

Constitution of phosphate slags, and their meaning for the production of Thomas meal. F. KÖRBER AND G. TRÖMEL. *Arch. Eisenhüttenwesen*, **7**, 7–20 (1933).—An investigation of equilibria in the system CaO–P_2O_5 showed the presence of four calcium phosphates. The tetraphosphate ($4CaO \cdot P_2O_5$) is identical with Hilgenstockit. The phosphates $2CaO \cdot P_2O_5$ and $3CaO \cdot P_2O_5$ show two modifications. The tetraphosphate and melts containing tetraphosphate will, at about 1100°C, decompose into lime and hydroxyl apatite provided that moisture is present. Heating to a temperature between 1300 and 1400°C will result in the formation of the tetraphosphate again. In the ternary system CaO–P_2O_5–SiO_2, the compounds $5CaO \cdot P_2O_5 \cdot SiO_2$ and $9CaO \cdot P_2O_5 \cdot 3SiO_2$ are formed, as well as mixed crystals over a wide range. Solubilities were determined of crystals containing phosphoric acid. It was found that raw phosphate which is added to a viscous melt may decompose if alkali and sand are added simultaneously. The economy of this method of decomposing is still under investigation. W.M.C.

Equilibrium diagram of the antimony-manganese system. TAKEJIRÔ MURAKAMI AND ATSUYOSHI HATTA. *Sci. Repts. Tôhoku Imp. Univ.*, **22** [1], 88–100 (1933).—The equilibrium diagram of the antimony-manganese system has been determined by means of thermal analyses, electrical resistance measurements, and microscopic examinations. Three intermetallic phases exist, η(MnSb), ϵ(Mn_2Sb_2), and δ(Mn_2Sb). MnSb solidifies at 809°C forming no solid solution. The η-phase forms a eutectic with 9.5% Mn at 570°C. Mn_2Sb_2 is produced by a peritectic reaction at 872°C and forms a series of solid solutions in the range from 32 to 41% Mn. Mn_2Sb forms a solid solution in the range from 45 to 50% Mn at a high temperature and in the range from 47 to 48% Mn at room temperature. The δ- and β-phases form a eutectic at 922°C and 55% Mn, the change extending up to 6.52% Sb on the Mn side. The β-phase forms a eutectoid at 677°C and 6.5% Sb. γ-Mn will change to β-Mn by a peritectic reaction at 1202°C. W.M.C.

Hydrated titanium oxide. Thermal precipitation from titanium sulfate solutions. A. W. HIXSON AND W. W. PLECHNER. *Ind. Eng. Chem.*, **25** [3], 262–74 (1933).—In industrial precipitation of titanium oxide by hydrolysis it is necessary to regulate the acidity as well as the titanium oxide concentration to obtain high yields economically. The maximum percentage precipitated in the time periods studied decreases with increased acidity. Titanium sulfate solutions may be precipitated more than 95% by boiling for less than 8 hr. when such solutions contain 6 to 10% of titanium oxide and the ratio of excess sulfuric acid to titanium oxide is one or less than one. Illustrated. F.G.H.

Measurement and control of hydrogen-ion concentration. GEORGE A. PERLEY. *Chem. Met. Eng.*, **40** [8], 417–20 (1933).—P. considers four potentiometric methods including the hydrogen electrode, the quinhydrone electrode, the antimony electrode, and the glass electrode, as well as a variety of colorimetric measuring methods. A.K.

Effect of hydrogen-ion concentration on the flocculation values of chromic and aluminum oxide sols. M. H.

BEDFORD, W. H. KELLER, AND J. L. GABBARD. *Jour. Amer. Chem. Soc.*, **55** [10], 3953–56 (1933). F.G.H.

Drying of solids. T. K. SHERWOOD AND E. W. COMINGS. *Heating-Piping*, **5** [4], 187 (1933); *Ind. Eng. Chem.*, **25**, 311–16 (1933); for abstract see *Ceram. Abs.*, **12** [3], 132 (1933). J.L.G.

Flow of simple fluids through porous materials. G. H. FANCHER AND J. A. LEWIS. *Ind. Eng. Chem.*, **25** [10], 1139–47 (1933).—The porosity and screen analysis of each sample are determined. The data are used in the construction of a friction factor chart in terms of the properties of the fluids and the porous materials. The conclusions are as follows: (1) the flow of fluids through porous materials closely resembles that through pipes; (2) there is a condition of flow in porous systems which resembles viscous flow and another which corresponds to turbulent flow; (3) the change from one type to the other takes place at a definite and reproducible condition for each system; and (4) the permeability and conditions of flow for any simple fluid through porous materials can be approximated by use of the relationships which are found. Illustrated with charts, diagrams, and photomicrographs. F.G.H.

Old observations on the vitreous state and devitrification. ANON. *Rev. belge ind. verrières, céram., émail.*, **4** [6], 123–24 (1933).—Excerpts are given from the book of Buffon (celebrated French naturalist, 1707–1788), Histoire Naturelle des Mineraux, dealing with the vitreous state and devitrification. M.V.K.

Heat conductivity. M. JAKOB. *Physik*, **1** [3], 123–30 (1933).—Methods and results are discussed for gases, liquids, nonmetallic substances, and metals. Technical applications such as boiler construction, heat insulation of buildings, etc., are discussed. W.M.C.

BOOKS

A Text Book of Theoretical and Inorganic Chemistry. F. A. PHILBRICK AND E. J. HOLMYARD. vii + 803 pp. J. M. Dent and Sons, Ltd., London, 1932. 10s 6d. Reviewed in *Nature*, **132** [3325], 116–17 (1933).—The book is divided into three sections, *viz.*, historical, general, and special. In the latter, the division of the elements is made into groups according to the periodic system. J.L.G.

Technical Electrolysis of Water Solutions. (Technische Elektrolyse Wasseriger Losungen.) **Handbook of Technical Electrochemistry. Vol. II, Part I.** V. ENGELHARDT. Akademische Verlagsges., Leipzig, 1933. 451 pp. Reviewed in *Trans. Faraday Soc.*, **29** [8], 879 (1933). G.R.S.

Phase Rule Studies. J. E. W. RHODES. *Mining & Met.*, **14** [323], 3 (1933); for abstract see *Ceram. Abs.*, **12** [12], 435 (1933). E.J.V.

Practicum of Chemical Analysis with X-Rays. G. v. HEVESY AND E. ALEXANDER. *Jour. Inst. Metals*, **53** [9], 539 (1933); *Ind. Eng. Chem.*, **25** [11], 1300 (1933); see also *Ceram. Abs.*, **12** [12], 435 (1933). F.G.H.

Elements of Engineering Thermodynamics. J. A. MOYER, J. P. CALDERWOOD, AND A. A. POTTER. John Wiley & Sons, Inc., New York, 1933. 192 pp. Price $2.50. Reviewed in *Power*, **77** [9], 495 (1933). F.G.H.

PATENTS

Sodium aluminate. L. M. CLARK AND H. M. SPITTLE (Imperial Chemical Industries, Ltd.). U. S. 1,931,374, Oct. 17, 1933.

Production of titanium dioxide from titanium tetrachloride. HERMANN HABER AND PAUL KUBELKA (Krebs Pigment & Color Corp.). U. S. 1,931,380 and 1,931,381, Oct. 17, 1933.

Process of producing titanium dioxide. H. L. RHODES (Glidden Co.). U. S. 1,931,682, Oct. 24, 1933.

Making titanium dioxide. H. W. RICHTER. U. S. 1,932,087, Oct. 24, 1933.

General

Ceramic education symposium. ANON. *Bull. Amer. Ceram. Soc.*, **12** [11], 319–24 (1933).

Ceramic education. EDITORIAL. *Bull. Amer. Ceram. Soc.*, **12** [11], 311 (1933).

Economic waste in education. ARTHUR OLIVER. *Bull. Amer. Ceram. Soc.*, **12** [11], 318 (1933).

A century of progress in ceramics. J. C. HOSTETTER. *Ceram. Age*, **22** [2], 49–61 (1933); see *Ceram. Abs.*, **12** [12], 436 (1933). F.G.H.

Notes on ceramics abroad. F. M. MANSFIELD. *Ceram. Age*, **22** [2], 59 (1933).—A comparison of ceramic ware production in several foreign countries is presented. F.G.H.

Tell the public what you have to sell. HARRY H. POTTER. *Brick Clay Rec.*, **83** [2], 62–63 (1933).—The need for coöperation in advertising as well as in research on fired clay products is stressed. E.J.V.

We give them what they want but standardize just the same. MEREDITH SPEAR. *Factory Management & Maintenance*, **91** [7], 259–62 (1933).—The methods used in the plant of the A C Spark Plug Co. to fill widely varying orders and yet standardize as much as possible for the sake of efficiency and profitable production are described. Illustrated with photos and charts. J.L.G.

Preëmployment program of the German government and the brick industry. RAUCH. *Tonind.-Ztg.*, **57** [69], 803–804 (1933). W.M.C.

This year's crop of new ideas. ANON. *Ceram. Ind.*, **21** [5], 217–36 (1933).—A series of forty-six new developments in raw materials and equipment for the ceramic industry is described briefly. Illustrated. E.J.V.

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Reduction of solids. H. R. RAFTON (Raffold Process Corp.). U. S. 1,934,637, Nov. 7, 1933.

Clay. H. R. RAFTON (Rafton Engineering Corp.). U. S. 1,934,642, Nov. 7, 1933.